

Psychological adjustment and diabetic control

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SUMMARY Glycosylated haemoglobin concentrations, C peptide secretion, insulin dose, psychiatric state, intellectual functioning, and the extent to which the implementation of the diabetic regimen was shared between parent and child were studied in a cross sectional study of 50 children with diabetes aged 6–16. Indications of psychological disturbance in the children and their parents predicted low glycosylated haemoglobin concentrations in the children, and accounted for 44% of variance in blood glucose control. The child's early and independent participation in the implementation of the diabetic regimen was associated with poor control.

Children and adolescents with insulin dependent diabetes mellitus who have problems in maintaining blood glucose control often have emotional disturbance as well.^{1,2} Where problems in blood glucose control have not been severe enough to warrant recurrent admissions to hospital, the evidence for an association with psychological disturbance has been less consistent.^{3–7} The inconsistencies may be due to measures of blood glucose control which are open to bias and error, failure to consider biochemical indications of residual endogenous insulin secretion (C peptide), and superficial, unstandardised, single blind psychiatric evaluations. It is now possible to assay haemoglobin A1 (HbA₁) concentration, (which reflects average blood glucose concentrations over the past six to eight weeks), and standardised psychiatric assessment techniques have been developed that permit a more rigorous examination of the association between psychological adjustment and diabetic control.

The association between psychiatric disorder and poor blood glucose control has been explained by poor adherence to the diabetic regimen among psychiatrically disturbed patients.^{8,9} We have examined the association between blood glucose control (measured by HbA₁ assay), psychological adjustment, and patterns of diabetic management in a sample of children for whom C peptide measurements and other clinical variables were available.

Subjects and methods

The study comprised all 71 diabetic children (aged 6 to 16 years) attending the outpatient department

of a rural district general hospital. Families of patients who met the selection criteria were approached individually. The criteria were duration of diabetes of at least six months, absence of major medical problems unrelated to diabetes, and absence of major intellectual impairment. Of the 61 patients meeting the criteria, 50 (85%) agreed to participate in response to a letter from the consultant.

Table 1 gives details of the children. There were slightly more over the age of 12, and the median duration of illness was 3.5 years. Social class was determined using the Registrar General's classification; the sample showed a slight bias towards middle class families. Fifteen per cent of the children came from broken homes. The 11 families who did not participate were comparable in sex ratio, social class, and age with the children studied, and 18% were single parent families.

The questionnaires were completed and psycholo-

Table 1 Details of the 50 diabetic children studied

Variable studied	Measurement	
	Mean (range)	No (%)
Age (years)	11.8 (6.2–16)	
Duration of illness (years)	4.2 (0.8–12.7)	
HbA ₁ concentration (%)	11.9 (7.6–18.1)	
Daily units of insulin/kg	1.0 (0.45–9.14)	
No of boys		24 (48)
Children in social classes I and II		16 (32)
One injection/day		32 (64)
C peptide >50 pmol/l		13 (26)

gical assessments made when the parents and diabetic children made a special visit to their local clinic for the purpose of participating in the study. Single blood samples were obtained after breakfast within five days to 18 weeks (average five weeks) after collection of the psychological data. HbA₁ measurements were performed using the Corning electrophoretic method.¹⁰ The normal reference range for the laboratory was 5–8%. Additional endocrine assays included measurement of C peptide secretion (blood glucose >8 mmol/l); plasma was considered to contain C peptide if the assay result was greater than 50 pmol/l (the detection limit of the assay). Clinical data recorded included units of insulin/kg and the percentage of children taking long acting insulin. Comparable data on endocrine function were not available for the children in the clinic who did not agree to participate in the study.

Intellectual and educational development were assessed using the Wechsler intelligence scale for children (revised) and the Schonell reading test. Information concerning psychological adjustment was collected using four independent sources. The parents completed a standardised questionnaire of psychological disturbance concerning their child, as did the child's school teacher.¹² The children received a standardised individual psychiatric assessment by semistructured interview with a consultant psychiatrist.¹³ The interview offered children the opportunity to express themselves spontaneously on various topics or in play. The children also saw a psychologist for assessment and testing which included the Eysenck personality questionnaire (junior).¹⁴ Neither examiner had information about the child's diabetic control. The parents' psychiatric states were assessed using the 30 item version of the general health questionnaire, a standardised self report.¹⁵

Information concerning the child's diabetic regimen was obtained using a specially derived 55 item questionnaire, the diabetic management profile, that was completed by the parents. This was divided into sections concerning diet, insulin injections, urine testing, blood testing, and a set of miscellaneous items relevant to the maintenance of diabetic control. Parents were asked to record the degree of responsibility taken by members of the family for specific parts of the child's diabetic management and to answer questions concerning emotional and behavioural aspects of the child's responses to the demands of the diabetic regimen. The questionnaire yielded scores on three sets of empirically devised scales covering the areas of adherence to the regimen, emotional response to the demands of treatment, and the degree of participation in implementing the regimen by the

child and other members of the family. The agreement between mothers and fathers completing the questionnaire independently was 82%, and the mean alpha coefficient for the scales was 0.84.

Mean HbA₁ concentrations of the children, grouped according to parents' responses to items in the questionnaire concerning diabetic management, and according to the child's scores on the psychological tests used, were contrasted using two way analyses of covariance, with sex as the second grouping factor. Two sets of covariates were used. The first comprised the child's age and duration of diabetes; these ensured that differences between the groups could not be accounted for by age or duration of the disease. The second set of covariates extended the first by including C peptide secretion and daily dose of insulin (units/kg) to control for the effects of residual insulin production and insulin dose. Thus the procedure statistically equated the groups for variables known to be important determinants in control of blood glucose concentrations. In the case of continuous variables partial product-moment correlation coefficients were computed controlling for the same sets of variables. A multiple linear regression equation was computed using demographic, clinical, and psychiatric variables to identify the combination of biochemical indices, demographic characteristics, and measures of psychological disturbance providing the best prediction of HbA₁ concentrations.

Results

Table 1 shows the clinical data and measurements of endocrine function. The mean HbA₁ concentration was high at 11.9%. Twenty six per cent of the sample had detectable C peptide in plasma indicating residual endogenous insulin secretion. The insulin dose (units/kg) correlated significantly with HbA₁ concentrations ($r=0.28$, $df=48$, $p<0.03$). C peptide secretion was not associated with HbA₁ concentrations. A separate analysis of the data on the subgroup of children over 12 years old, however, showed that the group with detectable C peptide had lower mean HbA₁ concentrations (12.2% and 10.4%, respectively), and this difference was significant (F_1 , ($df\ 21$)=6.5, $p<0.02$). In this age group the number of daily injections also predicted HbA₁ concentrations. Thirteen of 25 patients having two injections a day had a mean HbA₁ concentration of 11.4%, compared with 12.9% in those adolescent subjects having a single daily injection (F_1 , ($df\ 21$)=5.8, $p<0.04$). Cognitive functioning did not predict HbA₁ concentration.

As children behave differently under different circumstances, multiple screening was used to avoid

missing genuine cases of psychological disorder.¹⁶ Psychosocial adjustment was assessed in terms of the persistence and severity of emotional and behavioural problems, using three psychometric tests and an interview with the child by a psychiatrist. The recommended cut off scores were used for all tests to identify children with appreciable emotional and behavioural difficulties.^{12,13} About 25% of children showed some indication of disturbance in at least one of the tests used, and 6% of the children showed signs of severe psychiatric disorder according to the psychiatrist's rating. The extent of overlap between the screening tests for parents and teachers was low (45%), but the agreement of these with the psychiatric rating was higher (55% for teachers and 78% for parents).

There was a consistent association between good control of blood glucose and psychiatric disturbance using several measurements. A strong negative correlation emerged between HbA₁ concentrations and the neuroticism scale of the Eysenck personality questionnaire ($r=0.49$, $df=44$, $p<0.001$). Neuroticism scores were higher for children with moderately better glycaemic control, but no further associations with glycaemic control were observed on the other variables in the Eysenck personality questionnaire (table 2). Among younger children (under 12 years),

those noted to have psychological problems (by parents, teachers, or the psychiatrist) had significantly lower HbA₁ concentrations than those in whom disturbance was not found (table 2). Analyses of covariance showed that these associations could not be accounted for by differences of insulin dose or C peptide secretion. Analysis of the single items of the screening tests showed that a larger number of specific symptoms of emotional disturbance predicted low HbA₁ concentrations better than did specific symptoms of behavioural disturbance. Examples of the symptoms of emotional and behavioural disturbance which predicted HbA₁ values included worry—as noted by the parents ($F_{1, (df 38)}=4.6$, $p<0.04$)—apprehension—as noted by the teacher at school ($F_{1, (df 41)}=6.2$, $p<0.01$)—and a tendency to bully other children—as noted by the parents ($F_{1, (df 33)}=6.2$, $p<0.02$). Thus several psychiatric measurements showed that children with psychological difficulties had significantly better blood glucose control than those in whom there were no problems of psychological adjustment.

The association between parents' psychological disturbance and their child's metabolic control was similar. Children whose fathers were classified as probable psychiatric cases by the screening tests were found to have better blood glucose control

Table 2 Mean HbA₁ concentrations of children with and without behavioural and emotional problems

	No of cases	Mean HbA ₁ (SE) (%)	Statistics
<i>Total sample:</i>			
Problems noted at home (symptom score >13)	9	11.1 (0.4)	
No psychological disorder noted (symptom score <13)	36	12.6 (0.5)	$F_{1, (df 36)}=7.0$, $p<0.02^+$
Self-rated neuroticism (mean=9.7, SD=4.8):			
Low (1-5)	12	13.7 (0.6)	
Moderate (6-14)	23	11.9 (0.3)	$F_{2, (df 38)}=8.6$, $p<0.001^*$
High (15-18)	6	10.9 (0.6)	$F_{2, (df 29)}=3.9$, $p<0.03^+$
<i>Children under 12:</i>			
Problems noted by psychiatrist, parent, or school	14	11.1 (0.4)	$F_{1, (df 18)}=9.6$, $p<0.006^*$
No psychological disorder noted	8	13.4 (0.7)	$F_{1, (df 16)}=5.4$, $p<0.04^+$

*Results of the analysis of covariance controlling for age and duration of diabetes.

†Results of the analysis of covariance controlling for age, duration of diabetes, C peptide, and daily units of insulin/kg.

Table 3 Mean HbA₁ concentrations of children grouped according to parents' psychiatric problems

	No of cases	Mean HbA ₁ (SE) (%)	Statistics
<i>Mother:</i>			
Probable case (score >4)	12	11.3 (0.5)	
Not probable case	33	12.3 (0.3)	$F_{1, (df 34)}=5.3$, $p<0.03^+$
<i>Father:</i>			
Probable case (score >4)	8	10.1 (0.7)	$F_{1, (df 33)}=7.9$, $p<0.008^*$
Not probable case	29	12.2 (0.6)	$F_{1, (df 27)}=5.7$, $p<0.03^+$

*Results of the analysis of covariance controlling for age and duration of diabetes.

†Results of the analysis of covariance controlling for age, duration of diabetes, C peptide, and daily units of insulin/kg.

(table 3). Similarly, children whose mothers scored in the pathological range had significantly lower HbA₁ concentrations than children whose mothers' score did not place them in the disturbed group (table 3).

Only one of the three sets of scales of the diabetic management profile was found to predict HbA₁ concentrations. The scale measuring the child's independence in implementing various aspects of the treatment regimen was found to correlate with poor blood glucose control when age and duration of illness were checked ($r=0.30$, $df=47$, $p<0.01$). Those children under the age of 12 who relied on their parents for help in implementing various aspects of the regimen were particularly likely to have lower HbA₁ concentrations ($r=0.61$, $df=17$, $p<0.002$). A number of individual items which made up this scale predicted HbA₁ concentrations; children who independently administered their injections (F_2 , ($df\ 38$)= 3.1 , $p<0.05$) and tests for glycosuria (F_1 , ($df\ 35$)= 4.1 , $p<0.02$) and who were responsible for the timing of their meals (F_1 , ($df\ 36$)= 3.2 , $p<0.05$) had higher HbA₁ concentrations, even when the influence of age and duration of disease was allowed for.

The association between the child's independence in management and HbA₁ concentrations accounted for some of the common variability between psychological disturbance in the children and blood glucose control. For example, the correlation between the presence of psychological disturbance rated by parents, teacher, or psychiatrist and HbA₁ concentration was 0.54 for the 22 children under 12 years. When the scale score for the child's independence in implementing the management was controlled for, however, the resulting partial correlation was substantially reduced ($r=-0.09$, $df=19$, ns).

A hierarchical multiple linear regression was used to investigate the importance of the association of the measurements of psychological disturbance and glycaemic control. Initially all demographic and clinical variables were forced into the equation. The backwards stepwise procedure eliminated all but

residual endogenous insulin secretion in units of insulin/kg. A formal stepwise analysis was then used to specify the most important overall psychiatric measurements determining HbA₁ concentrations. Variables representing appreciable emotional and behavioural problems in the home, school, and psychiatric interview were considered, together with self rated neuroticism scores on the Eysenck personality questionnaire (junior). Two overall measures of psychological disturbance of the child (self rated neuroticism and the presence of appreciable psychological disturbance as perceived by the parents) were selected (table 4). A further stepwise procedure was then used to see if specific emotional and behavioural symptoms identified by the parents, teachers, and the psychiatrist could add to the prediction of HbA₁ concentrations made by clinical and overall psychiatric measurements. One such measurement, the restlessness of the child during the psychiatric interview, added slightly to the predictive power of the equation. Thus three psychiatric variables were selected and these combined with the clinical variables accounted for 44% of the variance in HbA₁ concentrations (table 4).

Discussion

The findings suggest that between a quarter and a third of children with insulin dependent diabetes mellitus have appreciable emotional and behavioural problems. This is higher than may be expected in a rural sample. In the absence of more rigorous methods of sampling the comparison between the present study and larger scale epidemiological surveys is not possible. The prevalence observed is, however, similar to that reported in other studies using an overlapping set of tests.⁵⁻⁷

There was a moderately strong association between indications of psychiatric disturbance in diabetic children and their parents, and good control of blood glucose. The strength and reliability of these associations using a number of measures are remarkable because they contrast with those found in past investigations with perhaps less comprehensively evaluated samples.^{5,17} Several authors have reported that chronic poor control associated with frequent hospital admission (brittle diabetes) is likely to be the consequence of major psychological difficulties.^{1,18,19} The present findings indicate that while patients with poor control may often be psychiatrically disturbed, psychiatric disturbance per se is not inevitably a cause of poor control in children. Indeed, it may be that anxious children tend to be more diligent in monitoring the subjective signs of poor blood glucose control and they counteract these more effectively.

Table 4 *Results of the multiple linear regression: psychiatric predictors of diabetic control*

Variables	Weights	t statistic	p values
C peptide	-0.58	-1.72	0.09
Units of insulin/kg	-1.81	-2.46	0.02
Neuroticism	-0.20	-3.66	0.007
Psychological problems noted at home	-2.00	-2.94	0.006
Gross activity level in psychiatric interview	-1.99	-2.53	0.02

$R=0.66$, F_5 , ($df\ 42$)= 6.48 , $p<0.0002$.

The results indicate that the child's assumption of responsibility for the administration of the regimen is associated with poor blood glucose control in children under the age of 12. Observational studies examining the quality of self management among children of this age have shown that both knowledge^{20 21} and skills in managing diabetes²⁰ are generally less than adequate. Parental participation in implementing the regimen may well ensure the provision of resources which are necessary but not sufficient to ensure good glycaemic control.²² These findings suggest a need for further research concerning the desirability of starting self care early in children with diabetes.

Psychiatric measurements predict HbA₁ concentrations independently of C peptide secretion. Parents who see themselves as taking a greater role in helping to administer the treatment were more likely to have children with reasonably good glycaemic control but with appreciable behavioural and emotional problems. When parental perceptions of the child's independence in management were analysed statistically, the association between glycaemic control and psychological disturbance was considerably reduced. We could thus interpret the data as indicating that anxious children may be more unwilling to take responsibility for the regimen, and their consequent dependence on their parents protects them from the adverse influence of precocious self care. In addition, anxious parents may be more concerned about their child's capacity to cope independently with the demands of the regimen and may therefore take a more active role in its implementation.

Our findings show a diversity of associations between psychological factors and glycaemic control, perhaps mediated by the range of coping responses of the children and their families that together make up the adjustment of the family to diabetes in the child.

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