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Clinical Characteristics of Insulin-dependent Diabetes Mellitus in Children at Diagnosis

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ABSTRACT

The clinical characteristics of 60 consecutive children <16 years in a Swedish county with newly diagnosed diabetes mellitus, are described. Twenty-four of them were 5.0-9.9 years old. The fathers of 12% had diabetes. There was no seasonal variation in the onset of diabetes. Presenting symptoms were polyuria and polydipsia in more than 90% of the cases. School children had a longer duration of symptoms than pre-school children. Most of the children were in a good state of health, and none were unconscious on admission. HbA1C was a good indicator of diabetes duration ($R^2 = 0.32$). Patients with Coxsackie B IgM antibodies had lower blood glucose than those without such detectable antibodies.

INTRODUCTION

Many important questions regarding predisposing factors and mechanisms for late complications in diabetes mellitus remain to be answered. This issue is of vital importance, as the late complications, cardiovascular and renal, are the main causes of death in patients with diabetes. Only few longitudinal studies on the development of complications are available (1-4), most of which concern adult patients.

The present paper represents the start of a study to investigate the long-term complications of childhood diabetes (5-8). It is important to describe the clinical characteristics of the population being followed up in a prospective study, as predisposing factors may already be apparent at the

beginning of the disease process. Awareness of risk factors could help in the planning of treatment and monitoring of the disease.

The aim of this paper is to present the clinical condition at diagnosis and the history of illness of the patients.

PATIENTS AND METHODS

Sixty patients less than16.0 years of age, 29 boys and 31 girls, were diagnosed as having diabetes mellitus during the period September 1982 to August 1986 in the county of Uppsala. All 60 newly diagnosed patients underwent a clinical examination at diagnosis, and the history of illness was analysed following a structured questionnaire. The examination and history-taking was carried out by one and the same physician (M.K.). Routine laboratory investigations were performed in addition to the above-mentioned special analyses. For statistical calculations Student's t test, linear regression analysis and Pearson's coefficient of correlation were used(9).

RESULTS

Family history

As seen in Table 1, the fathers of 12% of the children had diabetes mellitus, whereas none of the mothers had diabetes. Five per cent had siblings who were also suffering from diabetes.

TABLE 1. Family history of diabetes

Family member with diabetes	**Total** n = 60 **%**	**Girls** n = 31 **%**	**Boys** n = 29 **%**
Father	12	13	10
Mother	0	0	0
Siblings	5	7	3

Age at onset

The age distribution at the onset of diabetes is presented in Fig. 1. At onset, 17, 24 and 16 children were between 0-4.9 years, 5.0-9.9 years and 10.0-14.9 years of age, respectively.

Season of onset

There was no obvious seasonal variation in the onset of the diabetes (Fig.2.)

Fig 1. Age of the patients at diagnosis.

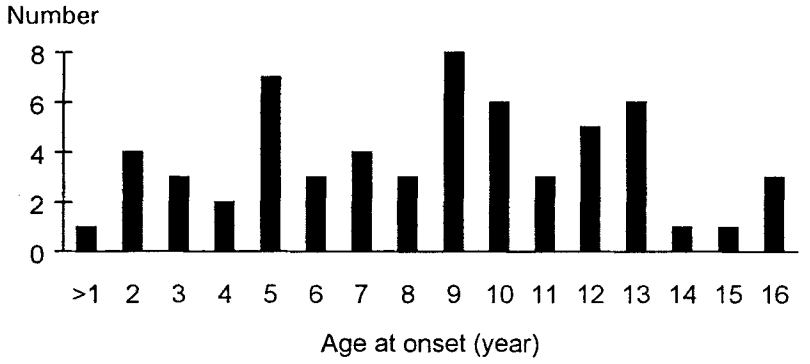
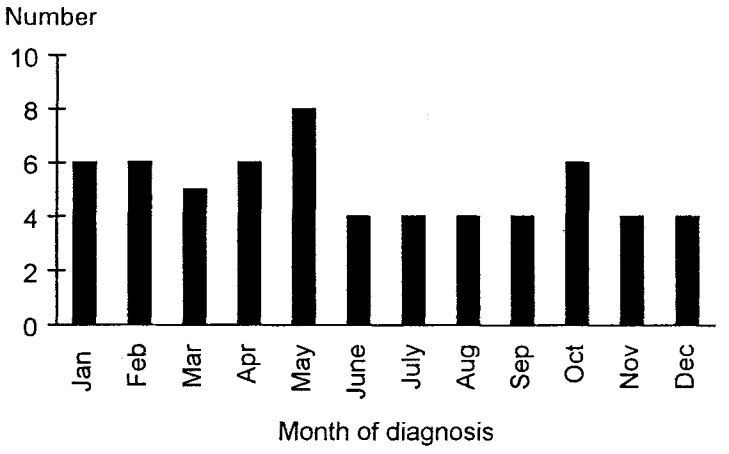


Fig 2. Distribution of the month of diagnosis



Common infections

Varicella was the most frequent common childhood infection (Table 2).

TABLE 2. History of common infectious diseases

Disease	Total n = 60 %	Girls n = 31 %	Boys n = 29 %
Parotitis	23	19	28
Morbilli	27	29	24
Rubella	28	19	38
Varicella	53	58	49
Pertussis	18	26	10

Intake of sweets

More than half of the patients had been used to consuming sweets once a week, and 34% had had more frequent consumption. Twelve per cent of the children answered that they did not eat any sweets at all (Table 3).

TABLE 3. Intake of sweets

Sweet consumption times per week	Total n = 60 %	Girls n = 31 %	Boys n = 29 %
None	12	10	14
Once	57	61	52
Twice	17	16	17
Three times	7	3	10
Four times	8	10	7

Presenting symptoms and their duration

The dominating symptoms were polyuria, polydipsia, fatigue and weight loss (Table 4). All boys and almost all girls had polyuria and polydipsia as the first observable symptoms, with a mean duration of 2 weeks. School children (7 - 15 years old) had a longer mean duration of these symptoms (16.5 ± 12.7 days) than pre-school children (<7 years) (10.8 ± 6.8 days) ($p<0.05$). Quite a few had had abdominal pain during the last days before diagnosis.

TABLE 4. Symptoms at diagnosis

Symptoms	Total n = 60 %	Mean durationn days	Girls = 31 %	Boys n = 29 %
Polyuria	93	14.2	87	100
Polydipsia	93	15.0	87	100
Fatigue	68	10.2	61	78
Weight loss	42	39.0	45	38
Abdominal pain	22	1.4	16	28
Unconsciousness	0		0	0

Condition of the patients at diagnosis

None of the 60 patients were unconscious when admitted to the Children's Hospital.

Very few pathological signs were found on admission to the hospital. The general examination, which included the lymphatic glands, ears, nose, chest, abdomen and heart with electrocardiogram, showed palpable lymphadenitis in 10% of the patients, but no other abnormalities. Five patients had a temperature of at least 38.0°C on admission. The blood pressure and heart rate were generally within normal limits for age and body temperature (heart rate 83±17), systolic blood pressure 112±10 mmHg and diastolic blood pressure 75±9 mmHg.

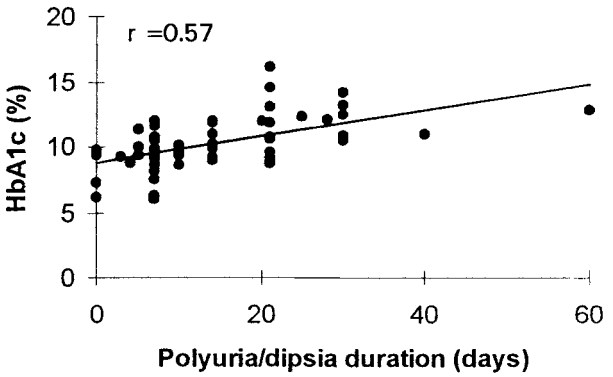
Pubertal development

Only 10 % of the girls had started their pubertal development (the mean age of all girls was 8 years 11 months). Six boys were pubertal (20%), of whom three (10%) had reached Tanner stage 4 or 5 (Table 5).

TABLE 5. Pubertal stages

Tanner Stage	Total n = 60 %	Girls n = 31 %	Boys n = 29 %
1	85	91	79
2	7	7	7
3	3	3	3
4	3	0	7
5	2	0	3

Fig 3. Relation between duration of polyuria and HbA1c.



Laboratory investigations at diagnosis

Haemoglobin A1c (HbA1c) was high at diagnosis in this group of patients(10.3±2.0%) (ref 4.1-6.0), as was the blood glucose (20.7±9.6 mmol/l). HbA1c was positively correlated to the duration of polyuria ($r=0.57$, $R^2 = 0.32$, $p< 0.01$)(Fig.3). Acid-base balance was only slightly

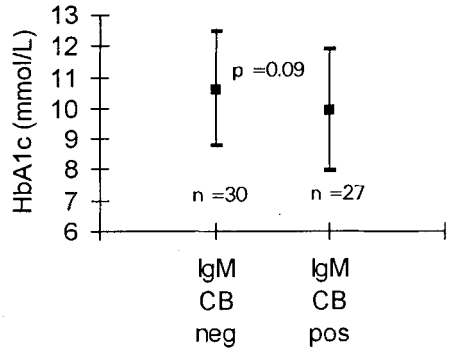
disturbed in most cases (Table 6.) Most patients were not dehydrated. There was no significant relation between the age at onset of diabetes and HbA1c, pH or blood glucose.

TABLE 6. Laboratory investigations at the time of diagnosis

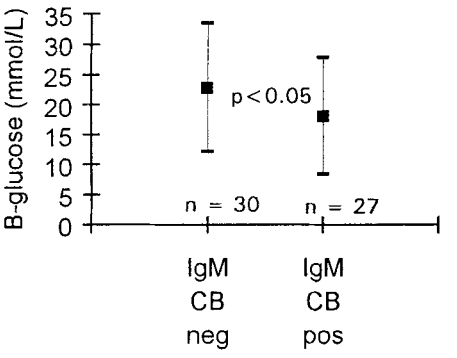
	n	Mean	±SD
B-Hb (g/l)	60	136.6	± 12.1
EVF (%)	49	39.7	± 5.0
B-Bicarbonate (mmol/l)	51	20.7	± 4.9
Base excess	53	-1.53	± 6.8
pH	52	7.37	± 0.07
B-glucose (mmol/l)	60	20.7	± 9.6
U-glucose (mmol/l)	60	43.9	± 377
B-HbA1c (%)	60	10.3	± 2.0
U-Albumin	59	2pos / 59	
U-Acetoacetate	60	30pos / 60	

Fig 4. HbA1c levels (4a) and blood glucose (4b) in IgM Coxsackie B (CB) negative and IgM CB positive patients.

4a



4b



Coxsackie B antibodies

In 57 children analyses were performed for Coxsackie B (CB) IgM antibodies. In the 27 children with IgMCB antibodies, initial blood glucose concentration was significantly lower ($p<0.05$) (Fig.4b), whereas HbA1c only showed a tendency to lower values (Fig. 4a). The Coxsackie B positive and negative cases did not differ regarding any of the other variables studied.

DISCUSSION

In this study we have been able to investigate all new cases of diabetes mellitus under the age of 16 in a Swedish county during a period of four years. The paternal heredity in this material is high, which is in accordance with the findings in other Swedish studies, but here it is even more pronounced. In our study material, the fathers of seven out of 60 patients (12%) had diabetes type 1, but no mothers had the disease. In a recent epidemiological study in Sweden on 2.300 patients, it was found that the fathers of 131 patients (6%) and the mothers of 56 patients (2%) had the disease (10). The age at onset of the disease was fairly evenly distributed, with the age group 4-9.9 years slightly dominating. This is in agreement with recent reports from Finland and Sweden, of a slight shift towards younger ages (10, 11).

The absence of seasonal variation is unusual. Even in this relatively small material a winter/summer difference would have been expected, especially as there was a winter peak in the county of Uppsala in 1983, a year included in our study period. However, besides viral disease, a large number of hereditary, age- related, psychological and environmental factors have been proposed as having a possible impact on seasonality (10-14). These 60 consecutive children with newly diagnosed IDDM did not differ from the general population with regard to the incidence of the common epidemic childhood infections. Although there may have been some underestimation regarding the intake of sweets, it is still noteworthy that 12% of the patients denied any intake. The dominating symptoms at all ages were polyuria and polydipsia. The patients and parents almost invariably reported the same duration for these two symptoms.

The longer symptom duration in school children compared with pre-school children is interesting. It is well known that the course of the disease is more rapid in younger than in older children, but

it may be hypothesized that older children are not as intensively and continually observed by their parents as younger ones, and therefore come to diagnosis later. The variation in the duration of polyuria explained 32% of the variation in HbA1c at diagnosis. Thus HbA1c is a useful measure of pre-diagnosis disease duration.

The condition of the patients at diagnosis was generally good. There were no unconscious patients. This is probably due to the good educational level in the Swedish general population regarding the initial symptoms and signs of juvenile diabetes. The 27 patients (47%) with IgM antibodies to Coxsackie B at diagnosis showed no significant difference from those without such antibodies, except for lower blood glucose values. In addition, they had a tendency to have lower HbA1c levels. Further studies are needed to clarify the question as to whether there are different types of IDDM, varying in aetiology and degree of residual insulin secretion, as has been proposed (14). Except for the absence of seasonality in the incidence of the disease, the findings are similar to those in other Scandinavian studies of IDDM patients, and confirm the ongoing shift to earlier ages. IDDM in the father, and the presence of Coxsackie B virus antibodies are two established risk factors for IDDM. HbA1c was a valuable measure of the pre-diagnosis disease duration, the latter explaining one-third of the variation in HbA1c. The possible clinical difference between Coxsackie B positive and negative patients requires further investigations.

ACKNOWLEDGEMENTS

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