PAPERS AND ORIGINALS

Obstetric history of diabetics: its relevance to the aetiology of diabetes

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Summary and conclusions

The birth weights of infants born to patients with insulin-dependent diabetes (IDD) and insulin-independent diabetes (IID) before the disease was diagnosed were compared. An appreciable excess of infants above the 90th centile for weight was found, the proportions being 27% of infants born to mothers with IDD and 30% of those born to mothers with IID.

These findings suggest that many patients with both types of diabetes have a prolonged period of metabolic abnormality before overt symptoms of diabetes arise and that the apparent acute onset of the disease in patients who are insulin dependent is illusory.

Introduction

Recently interest in the aetiology of "idiopathic" diabetes has increased and it has been suggested that the pattern of disease variously termed "juvenile-onset," "insulin-dependent," or "type I" may be initiated in a genetically predisposed individual by a primary viral insult leading to autoimmune destruction of the islet B cells.¹⁻³ Observations advanced in favour of this aetiological hypothesis are that such patients often present with a history suggestive of a rapid onset. A seasonal variation in incidence has been described in young diabetics corresponding to peaks of viral infection.⁴ In children peaks of age of onset have been observed that might correspond to new experiences—for example, starting or changing school—accompanied by exposure to a new range of viruses.⁵ Serological studies have suggested a possible link between juvenile-onset diabetes and infection with Coxsackie B₄ virus.^{4, 6} Since in animals the immune

response to antigens including viruses is strongly influenced by genes within the major histocompatibility complex,⁷ a conceptual link is suggested between inheritance of particular HLA genes, acute virus infection, and subsequent autoimmune destruction of pancreatic islet cells. Such epidemiological data are quite compatible, however, with a less fundamental role for acute viral infection—namely, the precipitation, by non-specific stress, of overt symptoms in an individual who has had incipient or sub-clinical diabetes for some time. Nor does the statistical association between type 1 diabetes and particular alleles of the HLA system give any unequivocal clues about the underlying pathogenic mechanism.

A prolonged "prediabetic" state characterised, among other things, by giving birth to abnormally large babies is thought to be a characteristic feature of maturity-onset, insulin-independent, or type 2 diabetes, which may have a quite different aetiology.⁸ It is implied that patients with type 1 diabetes who have a rapid onset do not exhibit this phenomenon.⁹ Maternal obesity has also been related to the size of babies born before the diagnosis of diabetes.⁸ To establish whether a prediabetic period of metabolic abnormality exists and, if so, its duration, we have investigated the obstetric history, including birth weights of offspring, of patients who later developed different types of diabetes.

Patients and methods

We interviewed 284 patients attending the diabetic department who before being diagnosed as diabetic had had one or more pregnancies lasting over 28 weeks. We asked them to recall the outcome of pregnancy and date of birth, gestational age, and birth weight of each baby. When diabetes had been diagnosed during a pregnancy or within six weeks after delivery the birth weight of that baby was not included in the analysis. Whenever the birth weight could not be recalled we recorded it as being under the 90th centile.⁹

The patients were grouped into those with insulin-dependent diabetes (IDD) and those with insulin-independent diabetes (IID) at the time of the interview (see table I). Some with IDD had had a long symptomatic history before diagnosis or were obese at diagnosis, or both, and their insulin dependency could therefore be disputed. They were classed as having "atypical" IDD for the purpose of analysis. On the other hand, patients with IDD who had had symptoms for less than six months before diagnosis, who were not obese at diagnosis, and who had been treated with insulin from the onset were

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classified as having "typical" IDD. The patients with IID were subdivided into those who were obese (over 120% of standard weight; Metropolitan Life Insurance Tables 1959) at diagnosis and those who were not.

The centile weight for gestational age was calculated from charts of birth weight.¹⁰ The percentage of babies born in Scotland weighing over 4500 g was calculated from recent figures.¹¹ We were able to check the accuracy of recall of birth weight and gestational age for 87 (46%) of the 191 patients aged 55 years and under (51 (47%) of the 108 with IDD and 36 (43%) of the 83 with IID) by scrutinising the hospital records.

Results

Table I shows the proportions of patients with babies over the 90th centile and weighing over 4500 g and the proportions of babies in these categories. The proportion of babies over the 90th centile was almost as high for mothers subsequently classed as having IDD (89 out of 330; 27%) as for those with IID (123 out of 407; 30%), although more patients with IID had a long (five years or more) prediabetic period as judged by the birth weight of offspring (table II). The incidence of overweight babies was slightly greater in patients with typical rather than atypical IDD (table I). In the patients with IID obesity did not appreciably increase the chances of having an overweight baby except in the few who developed diabetes under the age of 36 years.

The figures for babies weighing over 4500 g, included for comparison with other studies, showed the same trend, with a pronounced excess when compared with the 1% incidence of babies over this weight born in Scotland during the last few years. The recalled weights and gestational ages corresponded exactly with data from the case notes in 84 (97%) of the patients. In the remaining three cases (3%) the greatest error in gestational age was 1 week. In no case did this error affect the placing of a baby in table I.

Discussion

It appears to be a characteristic of the British culture that the birth weights of infants are precisely and indelibly recorded in the mother's mind. In the cases in which we were able to obtain documentary confirmation of the reported birth weight and gestational age the errors were minimal, and we are confident of the overall accuracy of the data given by the patients.

Confirmation could not be obtained in the oldest group of patients, and some may possibly have exaggerated the birth weights of their offspring.¹²

Many studies of the weights of offspring born to mothers who subsequently developed diabetes have been carried out since the original observation by Skipper¹³ in 1953 that such babies tended to be large.^{14 15} Few of the reports, however, have taken account of the clinical type of the mother's diabetes. Since most diabetic clinics see large numbers of elderly women with IID these patients are likely to be strongly represented in any retrospective study of the outcome of pregnancies in the prediabetic period. Hagbard,¹⁶ however, studied particularly those women who became diabetic during the childbearing period and found that 15% of babies born three to five years before diagnosis and 27% of those born one to two years before diagnosis weighed over 4500 g. Probably his study included a high proportion of patients with IDD and therefore, like the present survey, it provides evidence of a prolonged prediabetic metabolic abnormality in this group. Pedersen⁸ claimed that most overweight babies in his series were born to mothers who developed diabetes in association with obesity and who, by implication, had a mild form of the disease. Our findings in the rather small group of patients who developed IID before the age of 36 are comparable with Pedersen's data, but maternal obesity does not seem to be a very relevant factor in relation to the larger group of patients who developed IID later in life.

Interestingly, in the small group of young non-obese patients with IID there was an extremely low incidence of large babies. In some of these patients the disease probably belonged to the rather rare category of maturity-onset diabetes in the young.¹⁷

In patients with IDD bearing children more than five years before diagnosis of diabetes the risk of delivering an overweight baby—that is, more than the 90th centile—is about twice that found in the normal population. If the birth of overweight infants is acceptable evidence of a prediabetic disorder of carbohydrate intolerance then an appreciable proportion of women who develop classical IDD of apparently acute onset have a prediabetic metabolic abnormality. This phenomenon is equally common in underweight patients with IDD with symptoms of short duration and in overweight patients with IDD with a longer duration of symptoms.

TABLE I—Details of patients and babies and proportions of large babies born before diagnosis to patients with different clinical types of diabetes

Mean age (years) at diagnosis (range)	Diagnosis	Type of diabetes	No of patients	No (%) of patients with babies:		No of babies	No (%) of babies:	
				Over 90th centile	Over 4500 g		Over 90th centile	Over 4500 g
25 (19–35)	IDD	Typical	46	18 (39)	12 (27)	99	30 (30)	15 (15)
		Atypical	11	3 (27)	1 (9)	37	10 (27)	3 (8)
31 (20–35)	IID	Obese	9	3 (33)	3 (33)	18	6 (33)	4 (22)
		Non-obese	13	0	0	25	0	0
44 (36–55)	IDD	Typical	21	8 (38)	3 (14)	53	13 (25)	5 (9)
		Atypical	30	9 (31)	6 (20)	71	16 (23)	7 (10)
51 (36–55)	IID	Obese	26	12 (46)	4 (15)	82	32 (39)	11 (13)
		Non-obese	35	15 (43)	7 (20)	104	35 (34)	12 (12)
59 (56–74)	IDD	Typical	14	4 (29)	2 (14)	31	9 (29)	3 (10)
		Atypical	19	5 (26)	2 (11)	39	11 (28)	2 (5)
61 (56–81)	IID	Obese	20	8 (40)	6 (30)	64	20 (32)	11 (17)
		Non-obese	40	14 (35)	9 (22)	114	30 (26)	16 (14)

IDD = Insulin-dependent diabetes.
IID = Insulin-independent diabetes.

TABLE II—Proportions of babies over 90th centile according to number of years between their birth and diagnosis of diabetes in mothers

Interval between birth of baby and diagnosis (years):				0–	1–	3–	5–	10–	15–	20–	25–	≥30
				<i>Babies of patients with IDD</i>								
Total No	..	..	..	22	31	26	60	45	29	32	26	59
No (%) over 90th centile	..	..	..	12 (55)	8 (26)	11 (42)	14 (23)	9 (20)	5 (17)	6 (19)	6 (23)	8 (14)
				<i>Babies of patients with IID</i>								
Total No	..	..	..	4	4	4	29	34	38	52	63	179
No (%) over 90th centile	..	..	..	0	1 (25)	1 (25)	8 (28)	10 (29)	15 (39)	14 (27)	23 (37)	55 (31)

IDD = Insulin-dependent diabetes.
IID = Insulin-independent diabetes.

These findings suggest that the apparent acute onset of IDD in women aged over 18 years is often illusory. Women aged over 19 years with IDD¹⁸ and even younger patients¹⁹ may have a prolonged symptomatic illness before diagnosis, while Fajans *et al*²⁰ described chemical diabetes and abnormal insulin responses existing more than eight years before the development of overt IDD. Similarly, the pancreatic islet cell antibody has been described in patients, with other organ-specific autoimmune diseases, many years before the development of clinical IDD.²¹ A study of haemoglobin A₁ concentrations in newly diagnosed juvenile-onset IDDs has confirmed that the prediagnosis period of hyperglycaemia often extends far beyond the duration of diabetic symptoms.²²

This concept of an extended period of presymptomatic carbohydrate intolerance in a patient with IDD is compatible with that of a non-specific viral illness precipitating the onset of symptoms of clinical diabetes and hence with a seasonally variable incidence. Most patients included in the present study, however, developed clinical diabetes over the age of 20 years and all were parous women. It has recently been shown that such patients with IDD fail to exhibit a seasonal variation in incidence.^{18 23}

Two alternative hypotheses may therefore be proposed to explain the present findings. One supposes that more than one category of juvenile-onset diabetes exists, some cases being associated with a lengthy prediabetic phase and others being of genuine acute onset perhaps resulting from a viral infection. Alternatively, a prediabetic metabolic abnormality may be a general characteristic of IDD, acute viral illness merely acting as a trigger to precipitate clinical presentation of the underlying disease in some cases. At present it is not possible to choose between these hypotheses.

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References

- ¹ Cudworth, A G, *British Journal of Hospital Medicine*, 1976, **16**, 207.
- ² Irvine, W J, *Lancet*, 1977, **1**, 638.
- ³ Ganda, O P, and Soeldner, S S, *Archives of Internal Medicine*, 1977, **137**, 461.
- ⁴ Gamble, D R, and Taylor, K W, *British Medical Journal*, 1969, **3**, 631.
- ⁵ Bloom, A, Hayes, T M, and Gamble, D R, *British Medical Journal*, 1975, **3**, 580.
- ⁶ Gamble, D R, *et al*, *British Medical Journal*, 1969, **3**, 677.
- ⁷ Lily, F, and Pincus, T, *Advances in Cancer Research*, 1973, **17**, 231.
- ⁸ Pedersen, J, *The Pregnant Diabetic and her Newborn*, p 48. Copenhagen, Munksgaard, 1977.
- ⁹ Malins, J M, and Fitzgerald, M G, *Diabetes*, 1965, **14**, 175.
- ¹⁰ Gairdner, D, and Pearson, J, *Archives of Disease in Childhood*, 1971, **46**, 783.
- ¹¹ Walker, C H M, *Scottish Neonatal Annual Statistics*, University of Dundee Medical School, 1977.
- ¹² Malins, J M, *Clinical Diabetes Mellitus*, p 29. London, Eyre and Spottiswoode, 1968.
- ¹³ Skipper, E, *Quarterly Journal of Medicine*, 1933, **2**, 353.
- ¹⁴ Miller, H C, *New England Journal of Medicine*, 1945, **233**, 276.
- ¹⁵ Kriss, J P, and Fletcher, P H, *Journal of Clinical Endocrinology*, 1948, **8**, 380.
- ¹⁶ Hagbard, L, *Acta Obstetrica et Gynecologica Scandinavica*, 1958, **37**, 497.
- ¹⁷ Tattersall, R B, *Quarterly Journal of Medicine*, 1974, **170**, 339.
- ¹⁸ Gray, R S, Duncan, L J P, and Clarke, B F. In preparation.
- ¹⁹ Hamilton, D V, Mundia, S S, and Lister, R J, *British Medical Journal*, 1978, **2**, 211.
- ²⁰ Fajans, S S, *Archives of Internal Medicine*, 1976, **136**, 194.
- ²¹ Irvine, W J, *et al*, *Lancet*, 1977, **1**, 1025.
- ²² Spack, N, and Sendzischew, S, *Diabetes*, 1978, **27**, suppl No 2, p 464.
- ²³ Christau, B, *et al*, *Diabetologia*, 1978, **15**, 224.

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Evidential value of the hospital record in clinical decision making

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Summary and conclusions

A simulated retrospective exercise in the diagnosis and management of 53 readmissions to a gastrointestinal unit was undertaken by two consultants. Diagnosis of the illness at readmission was made on evidence sought from a referee, who also supplied, on request, items of relevant evidence from the past medical record. Patient management was agreed from these sources. For each item of evidence the evidential weight, the irrecoverability, and the expected benefit accruing to the patient of its availability was calculated.

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It was concluded that the evidence worth recording in the event of subsequent hospital admission could be largely specified for each diagnosis and each operation. It would be brief and could be numerically coded.

Introduction

In decision theory the medical record constitutes written information about the illness of a patient that may be relevant to current and future decisions. Such decisions may be of various kinds, and could be medicolegal or administrative or related to medical research, though more often and most important they are related to the current care of the patient and future care should he be readmitted.

Much interest had been aroused by the work of Weed,¹ who suggested a method of presenting clinical data that he called the problem-oriented record (POR). This method must be distinguished from the conventional one of recording data, which has been termed the source-oriented record (SOR).² The POR has received much favourable and some critical comment. We are concerned here not with the merits or demerits of the two systems but with the problem of determining what information should be included in the case record on the chance that it may influence clinical decisions in the future.