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Diabetes Mellitus in Adolescence

R. D. G. MILNER, MD, FRCP
Professor of Paediatrics, University of Sheffield, and
Paediatrician, Children's Hospital, Sheffield

Adolescence is always a difficult time, especially so for the diabetic. This review is a personal appraisal of the way the diabetic adolescent should be managed with the facilities available in the NHS and is biased towards hospital care since, as will become clear, the actual and potential problems encountered by the teenager are numerous and deserve the help of a specialist rather than a general practitioner in the first instance.

The initial question, and for some a fundamental one, is who that specialist should be; a physician with a prime interest in diabetes for whom children are a sub-group of patients, or a paediatrician whose remit is children but who may not be specially expert in the management of diabetes. To exaggerate the differences between the two serves to underline an important practical point in which one school, preoccupied with the risks of development of complications, seeks to develop control that will produce the most normal glucose profile at the risk of unreasonable constraint on the child's life-style, whereas the other school will accept any level of control that does not produce gross clinical disturbance. Thus, there may be one or several insulin injections daily, a strictly controlled or a 'free' diet, and no urine testing or urine tests four times a day for glucose and ketones.

The most important characteristic of diabetic care in adolescence is that the doctor should be experienced in handling growing children and diabetes mellitus. With those qualifications further designation is immaterial. The doctor must be able to offer a personal service and one that continues from childhood through to early adult life. Walker (1970) emphasised the importance of continuity, saying: 'The most difficult situations I encountered were after referral of an adolescent from the paediatric group when he or she had grown too old for the department and was possibly getting out of hand', and Shakespeare summarised the problem in *A Winter's Tale*: 'I would there were no age between ten and three-and-twenty, or that youth would sleep out the rest; for there is nothing in the between but getting wenches with child, wronging the ancientry, stealing, fighting'.

Another principle not sufficiently emphasised is the educative role of the doctor caring for the child with diabetes. Few adolescents have had diabetes for more than ten years and most are still at school. Hopefully, these patients are thereby conditioned to learn, and their doctor is in a unique position to teach them not just the rudiments of diabetic control but as much as each is capable of comprehending and is beneficial for self-control of the disease. This approach

enhances the appeal of a paediatric clinic, that is a clinic in which children are seen together by either a diabetologist or a paediatrician. A dietician and a health visitor can each offer specialist help efficiently, and the team approach is supplemented by the opportunity of the health visitor to review problems where they occur in the home and at school. But the clinic must not be overbooked. The most important receipt that the doctor can offer is time, and 15 patients is usually more than enough for a three-hour clinic. Details of management are a matter of personal experience and style not discussed in detail here, but which are well reviewed by Pond (1971) and Craig (1977).

An inevitable facet of diabetes in the teenager is the age at which the patient tranfers from a clinic dealing with children to one catering for adults. The undesirability of treating children in adult clinics is widely accepted but the problem of the age of transfer of children with chronic disease is sometimes overlooked. Is the adolescent who has spent years coming to the top of the roost in the paediatric out-patient department suddenly to find himself seated between a pair of crutches and a white stick in the new clinic? Facilities for a smooth transition are now being developed in several centres. In every case there is close liaison between the doctors caring for the child and the adult patients, so that compatible schemes of management are practised before and after the handover. In Sheffield these have been supplemented by the creation of a 'young adult' clinic with an upper age limit of 30 years to which nearly all teenagers are referred from the Children's Hospital. In this way the adolescent can relate to his peers and we believe that benefit may come from the time spent in the waiting room as well as that with the doctor. In a survey of teenage diabetics at an Oxford social club, J. D. Baum (personal communication) found that the age at which most children thought they would like to transfer to the adult clinic was 16 years, which is somewhat older than one might have expected. Perhaps a dependency of the young adolescent on the clinic he knows is hidden behind the façade of latent manhood.

PRACTICE

The teenager with diabetes is commonly in good health, and one of the selfish pleasures of running a diabetic clinic comes from making friends with a group of well children. The paediatrician is spared the complications that are so distressing to the adult diabetologist. But he is not excused a preoccupation with monitoring the clinical and biochemical status of his patient at regular intervals. This is not done easily in out-patients and, to ensure proper control, an annual 24 hour admission to undertake a detailed clinical examination and perform certain investigations is desirable (Table 1). In this way a log is compiled that can be carried forward into the 'young adult' clinic and will give, over the course of a decade or more, valuable longitudinal information on the development of complications. Long-term studies of this nature are not only good clinical

Table 1. Plan of investigation for 24 hour annual admission of a child or adolescent with diabetes mellitus.

Clinical history – in detail to supplement out-patient record	
paying particular attention to:	
	interaction of diabetes and life-style
	insulin injection technique
	dietetic comprehension
full examination with special reference to:	
	repeated blood pressure measurements
	fundoscopy after pupillary dilatation
	peripheral nerve function
laboratory: 24 hour urine for	creatinine clearance
	protein excretion
	glucose excretion
fasting blood for	glucose
	plasma lipid fractions
blood glucose profile	

practice but also form a matrix on which the effects of changes and developments in diabetic management can be assessed objectively.

Although there is no good clinical proof that the quality of diabetic control influences the onset of complications, the results of animal experimentation suggesting a causal relationship between the two have influenced clinical practice (Maclaren and Cornblath, 1976). What evidence of complications may be found in the adolescent?

THE EYES

Transitory refractory changes are the commonest ocular pathology in the diabetic but occasionally transient cataracts may occur (Bilginturan *et al.*, 1977). Whittington (1971) commented that cataract causing impaired vision is thought to occur in 1 to 3 per cent of diabetic children mostly over the age of 12 years, but that early abnormalities would be found in a much higher proportion if they were examined under a mydriatic by slit lamp microscopy. Classical diabetic retinopathy with punctate haemorrhages and exudates is rare in the adolescent.

NEUROPATHY

Clinical neuropathy causing symptoms or detectable by examination is also uncommon in the teenager, but objective testing by nerve conduction studies has shown a much higher incidence of abnormality. In a recent large and longitudinal study of 120 children, one-third of those over the age of five years had a subnormal peroneal nerve conduction velocity, and one-tenth an abnormality of median nerve conduction. In this group, 28 of 52 patients showed neuropathic

deterioration on repeated testing and 9 who were retested annually for five years had all deteriorated in that time. None of the patients had evidence of vascular changes, suggesting that the neuropathy occurred independently (Eng *et al.*, 1975). These findings are in general agreement with earlier studies and raise the possibility that recent refinements in nerve conduction technology may reveal an earlier and higher incidence of abnormality in the young diabetic. Autonomic neuropathy may occur in the diabetic adolescent but at present there is no idea of its incidence (Greenwood and Traisman, 1971).

VASCULAR DISEASE

Most diabetic adolescents have a normal blood pressure, but in those with a raised diastolic pressure of 90 mmHg or more the prognosis is unfavourable (Sterky, 1963). However, when microangiopathy is sought by direct examination of the nail bed capillary or renal biopsy a different picture emerges. Abnormality of the capillary nail bed was observed in half of 52 diabetic children aged between 5 and 17 years. The patients also had nerve conduction studies but no correlation was found between angiopathy and neuropathy (Otto-Buczkowska *et al.*, 1974). In the kidney, arteriolar hyalinosis was the commonest abnormality found by Fisher *et al.* (1967) in 9 of 12 diabetic patients aged 12 to 23 years. As in the adult, glomerular changes may occur in the diabetic child irrespective of the duration of the clinical disease, and Rees *et al.* (1964) have even suggested that microvascular changes in the kidney may be the earliest manifestation of the disease.

NEPHROPATHY

Proteinuria during ketosis or intercurrent renal tract infection does not necessarily indicate diabetic nephropathy. Persistent proteinuria is, however, the first indication of a slowly progressive diabetic nephropathy, and Pond and Oakley (1968) observed it in 12 of 134 diabetic subjects aged 16 years or less in whom the maximum duration of the disease was 12 years.

JOINTS

Grgic and his co-workers (1976) have drawn attention to a previously unrecognised complication of diabetes in children and adolescents. Review of 229 diabetics aged 7 to 18 years at a summer camp showed that 65 had contractures of finger joints. The child was asked to place the hands palm down with fingers fanned on a table top. Normally the entire palmar surface of the fingers makes contact. Patients unable to make contact with a portion of one finger, usually the proximal interphalangeal joint of the fifth were classified as Stage I and those more severely affected as Stage II. Of those affected, 47 were Stage I and 18 Stage II. The limitation of finger extension was usually symptomless and was not associated with muscle atrophy, palmar fascial thickening or altered sensation, but in some there was thickened adherent skin on the dorsal surface of the finger.

Radiographs were normal apart from thickening of the periarticular tissues. The significance of these findings and their prognostic implication requires further study.

DIABETIC DWARFISM

Growth retardation due to inadequate nutrition, which was so common before the days of insulin therapy, is now rare (Pirart, 1975). More frequent, but still uncommon, is Mauriac's syndrome (1930) characterised by height retardation, abdominal protuberance and hepatomegaly. In a review of 1512 case records of young diabetics seen since 1951, Lestradet and Megevand (1975) found 105 shorter than two standard deviations below the mean. Of these, 33 were more than three standard deviations below the mean and had hepatomegaly, an incidence of Mauriac's syndrome of approximately 2 per cent. Most physicians do not have so much case material and therefore have less clinical experience, but the uniformity of the diabetic picture is striking. Control is poor and is usually characterised by too much food and too much insulin, resulting in 'brittle' diabetes. The situation may result from disregard of dietetic advice or an over-conscientious attempt to avoid hypoglycaemia by increasing carbohydrate intake and the insulin dosage stepwise. The findings on liver biopsy are constant, the hepatocytes are stuffed with lipid and glycogen. No evidence of an enzymic defect has been found, though often sought by a physician faced with the problem for the first time.

Careful control, sometimes with long periods of in-patient care, results first in disappearance of hepatomegaly and then in resumption of a normal growth rate. Pond (1970) has shown how well-controlled boys and girls are, on average, taller than would be expected at the time of diagnosis. The adult height of the girls has a normal distribution but the boys end up shorter than would have been expected. Both sexes tend to have delay in the pubertal growth spurt and development of adult sexual characteristics. Mauriac's syndrome may be an exaggerated example of what is happening to all diabetics as they pass through their teens. The mechanism by which the developmental delay takes place is not understood but must be complex since it involves not only somatic growth but also sexual development.

SYNTHESIS

Although most studies have concentrated on defining the number of years of diabetes that elapse before the onset of complications, it is clear from the above review that focusing on the age band that encompasses adolescence shows a disturbing frequency of old children and young adults who manifest changes that will compromise the quality of their life to come. MacGregor (1977) has recently emphasised the gravity of the situation in a personal review of 45 patients in whom diabetes had begun before the age of 12 and who were now up to 30 years

old. The period of follow-up varied from 10 to 26 years. Of the 45, 7 or 15 per cent were dead, and 3 of the deaths were the consequence of diabetes. Perhaps even more disturbing was the observation that 2 of the patients had committed suicide and 3 others had attempted suicide.

In view of the incidence of the disease and its long-term prognosis one may conclude that high priority must be placed on ensuring continuity of care and a high quality of control of diabetes through adolescence.

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