Current Practice

Outpatient Management of Diabetic Children

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Diabetes mellitus affects about one per 1,000 children of school age. Few would disagree with the view that admission to hospital is essential for initial treatment and education of the child and parents. Views on the outpatient management of the diabetic child differ, however. Recommended regimens range from those in which insulin is given three times daily, together with a rigid diet in which all items are weighed, to those in which any limitation is rejected and regarded as a threat to the child's psyche. Neither of these extremes appears satisfactory and by using an intermediate approach much may be achieved without incurring psychological problems.

The long-term effects of an acceptable and stable outpatient course are often underestimated. It will influence the attitude of the child and the parents to the condition and will set the pattern for the whole of the child's life.

At a children's hospital it is beneficial for both care and morale for diabetic children to attend a special clinic; at the same time it is of great educational benefit to those looking after them. In smaller departments paediatricians will often find it useful to set aside a special clinic period at which the diabetic children may be supervised personally and where they may learn that there are others who are similarly affected.

Education for Management

There is no hope of success in the outpatient care of the diabetic child unless the education of parents and child has been adequate before the child is discharged home. This is vital for successful outpatient care and is the aspect most often neglected. On the whole, the parents' and child's attitude to the condition during most of his formative years will depend on the adequacy of this education: perhaps his long-term prognosis may also be affected.

No other condition places so much responsibility for day-to-day care on the parents, and there can be no excuse for sending the child home with parents and child ignorant of the condition. They must have a practical understanding of the metabolic disturbances in diabetes, the function of their particular insulins, the dietary interchanges to allow a fully varied diet, the purpose of urine tests, and the prevention of hypoglycaemia and ketosis. This education is time-consuming, often taking eight hours or more, and, if possible, should be supplemented by repeated lessons from the dietitian. A "final viva" lasting one and a half hours, during which parents and child are questioned on all aspects of diabetic management, ensures an adequate standard of knowledge before the child is discharged home. It also highlights any deficiencies in the teaching. Both parents must be involved in this education, and both must have given injections and must understand the condition so that they can help each other. Responsibilities often weigh heavily on the mother, who is likely to need much help and support.

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In the case of a large clinic, I believe that parents should feel free to telephone regarding diabetic problems which they cannot solve for themselves, especially during the early weeks after discharge. Since the British Diabetic Association can be so helpful in many ways, both through the literature and by means of local branch meetings, I always suggest that the parents should join on behalf of their child. Education does not end with discharge, of course, but requires repeated reinforcement at clinic visits. It is surprising how much may be forgotten at times.

Aims of Management

The aims of management may be summarized as follows:

To assist the child to (1) Accept diabetes and the new way of life it imposes. It is unreasonable to try to convince children that their life is unchanged when they may have a twice-daily reminder in the form of an insulin injection. (2) Lead a fully active and normal school life. (3) Manage diabetes with minimal glycosuria and minimal disturbance in insulin/glucose "balance." (4) Grow normally and mature into a fully integrated member of the community.

It is of course impossible to emulate the normal beta-cell responses to variations in blood glucose, but in most children and many adolescents it is possible to achieve a reasonable compromise without plaguing the patient's life with frequent hypoglycaemic reactions.

Diet

Much discussion revolves around the wisdom of using a regulated diet. Most antagonists suggest that dietary restrictions result in a disturbed psyche, that the majority of children adopt an approximately regular intake (unusual children, these), and that such diets have not been shown to be of benefit.

Knowles *et al.*,[1] discussing the course of juvenile diabetes treated with unmeasured diet, stated: "Hyperglycaemia and glycosuria were common, and ketoacidosis occurred often. Total plasma lipids were elevated. Chemical control was unsatisfactory according to current popular standards. Growth was less in those with onset before puberty and the men were underweight. Infections may have been excessive. Adolescent emotional difficulties were exaggerated. Education, athletic, and vocational achievements probably equalled the normal expectation."

At this clinic a regulated carbohydrate diet is recommended, the carbohydrates amounting to about 40% of the total calorie intake. Calorie requirements in individual children vary greatly, of course, but as a rough guide the child aged 1 year requires 100 g. (or 10 "portions") of carbohydrate, and this will increase by 10 g. a year until puberty. Diets are based on this initially and are then adjusted to the individual's require-

ments. The mother is also encouraged to give the child a good protein and moderate fat intake. Parents and children are taught all the items of diet that equate to 10 g. of carbohydrate, and work out weeks of menus before the child is discharged.

Several pamphlets and books compiled on this basis are available through the British Diabetic Association, and, provided the mother has adequate training, she can choose as varied a diet as most children are likely to demand—even diabetics.

Stealing of food by the established diabetic child is only very occasionally due to the fact that he has rejected his regimen. It is much more likely to be because his diet is insufficiently varied or that his intake has not kept pace with growth requirements. The pubertal child's natural tendency to increase his calorie intake with carbohydrate needs to be anticipated by discussing it with the mother beforehand. In the younger child stealing often results because some item is forbidden—nothing tastes better. If the young child finds it difficult to do without sweets a small amount should be included as part of the day's carbohydrate. This is to be preferred to the inevitable alternative, which will be likely to result in feelings of guilt.

Diabetic Control

Control is a much-argued concept, particularly as regards childhood diabetes. Glycosuria is undoubtedly best assessed by measurement of daily output. This has its limitations, however, since it may vary widely from hour to hour in any day, making complete 24-hour collection of little value so far as insulin adjustments are concerned. My criteria for control are shown in the Table. The aim is to achieve minimal glycosuria in second-voided specimens obtained before breakfast and the main evening meal and in a random specimen passed before lunch on the day of the clinic visit. On this basis complete absence of glycosuria for long periods is occasionally possible. In the great majority of children freedom from glycosuria can be achieved in their pre-breakfast urine test, and parents are asked to strive for this, provided "reactions" do not occur. In the test carried out before the main evening meal it is usually possible to achieve negative results on most days, with an occasional 0·5 to 1%.

Criteria Used for Assessment of Diabetic Control

Category	Preprandial Urine Specimens for Glycosuria		Occasional Clinic Blood Sugar (mg./100 ml.)	Hypoglycaemic Reactions	Other
	Daily Second-voided		Clinic Visit		
	a.m.	p.m.			
Good	Mainly 0%, occasionally 0·5%	Mainly 0%, occasionally to 1%	Up to 1%	< 150	Rare, mild only	Normal growth. Normal school life
	No ketonuria					
Fair	Mainly 0%, occasionally to 1%	Variable, but only occasionally 2%	Mainly 1%, occasionally 2%	150 to 250	Infrequent, mild	Normal or near normal growth. Normal school life
	No ketonuria					
Poor	Frequent 1–2%, only occasionally sugar-free		Up to 5%	> 250	Severe and/or frequent	Disturbed growth. Disturbed school attendance
	Any ketonuria					

In the younger adolescent it seemed necessary to be satisfied with frequent 1–2% glycosuria in the pre-lunch specimens brought to the clinic. The use, however, of the "two-drop" Clinitest method recommended by Belmonte *et al.*[2] was a good stimulus to improve control with more suitable insulin regimens. Glycosuria that previously would have been regarded as 2% amounted at times to 5%.

Falsification of urine tests is unusual, provided it is made clear to the parents and child that the test records are for their own benefit, to enable them to see what progress is being made and to adjust the insulin dosage accordingly. A condemning attitude to indifferent tests which are referred to as "poor" may result in false records. Control should be reassessed and the child advised without resort to such words. These records, when filled in with the appropriate colours, make it easy to assess overall control between clinic visits and constitute a responsibility which younger children welcome.

Insulin

The various insulins differ from each other, of course, but no insulin is better than the understanding of the person, not only the doctor, using it. Nevertheless, insulin zinc suspension (Insulin Lente), which contains 70% crystalline (Insulin Ultralente) and 30% amorphous (Insulin Semilente), is a poor insulin for use in children. For most, the excess of the longer-acting preparation results in frequent nocturnal "reactions"—occurrences which undermine the confidence of the whole family in their ability to cope with the disease.

Currently it appears possible to achieve optimal control in the younger child, according to the above criteria, with a mixture of amorphous and crystalline insulin zinc suspension in proportions adjusted by the parents at home. Often with the pubertal growth spurt the midday tests begin to show considerable glycosuria. If the two-hour postprandial blood sugar and/or serum lipids are raised a return to satisfactory values can usually be achieved by the use of a mixture of soluble and isophane (N.P.H.) insulins given twice daily and again adjusted by the child or parent at home until control is optimal. Occasionally this twice-daily regimen is successful in younger children whose control is otherwise unsatisfactory. Again, requirements vary with the individual, but as a rough guide about two-thirds of the total daily dose is necessary in the morning and one-third in the evening, the insulins being divided equally at each time. Children and parents are asked to adjust the dosage of this mixture until urine tests are satisfactory, when blood chemistry is again checked.

Apart from the first few weeks in the younger child, insulin injections are rarely a problem as regards physical pain; the psychological disturbance to a loving parent or child can, however, be very great and may require considerable discussion. Nevertheless, physical pain can occasionally be very real owing to injections being given at too shallow an angle, resulting in intradermal administration. Careful supervision during the initial education will prevent this and is important, since painful intradermal injection at this stage may result in a long delay before the injections are finally accepted.

The correct age for a child to give his or her own injections is when ready to do so and not before. It is often as early as 6 or 7 years, but may in some cases be as late as 11 years. Until it becomes a social inconvenience not to do so there should be no coercion.

It is far preferable for the child to learn by assistance with injections, accompanied by the gradual transfer of responsibility for them from the parents, than by a sudden ultimatum. Injection sites need to be watched and rotated carefully; lipoatrophy can be embarrassing for girls, and, in any case, repeated use of an old fibrotic area may result in gross irregularities in insulin release.

Hypoglycaemia

Hypoglycaemia should not occur often. Mild, easily controlled episodes with symptoms such as irritability, headache, abdominal pain, etc., occurring no more than once every two months or so are almost inevitable in the adequately controlled fully active child whose every vigorous and prolonged activity

cannot be anticipated. For preference the child should be allowed to experience mild hypoglycaemia during his initial stay in hospital in order that he may learn his own "reaction" pattern for himself before discharge. He should also know how to take appropriate preventive action without fuss.

Severe convulsive reactions should not occur. With the exception of the rare case in which the child has reactions with no warning whatsoever, convulsions are nearly always avoidable and are an indication for an immediate reduction in insulin and attendance at the next available clinic. In this respect it is often not realized that, in addition to exercise, sudden anger or fear in the postabsorptive state may cause a fall in blood sugar, especially if the level was high initially. This is very different from chronic anxiety or emotional tension, of course—"11+" and "O" levels will often lead to a period of instability with increased requirements.

School

The return to school should present no problems and will not do so if parents visit the school beforehand and explain the situation and the management of their child. Both the child and the teacher should keep glucose available, so that in the event of a mild "reaction" the child can correct it without bringing attention to himself. School activities, including games, physical exercise, etc., should be encouraged, as should educational school holidays, provided a responsible teacher is accompanying the party. In itself diabetes is not an indication for attendance at a special school. Occasionally, however, social problems may be insuperable, and in this event accommodation at a diabetic children's hostel may be useful.

Special Problems

(1) In about 1 in 20 children insulin requirements fall precipitously, often to zero, soon after discharge. This occurs usually in those who were not ketotic at diagnosis. These children are in a precarious state and infection may rapidly precipitate ketosis. Surprising insulin sensitivity may occur in such children—as, for example, a recently diagnosed 10-year-old boy who had "reactions" on two units of Semilente insulin, but developed ketosis when the amount was reduced to one unit per day.

(2) Occasionally true epilepsy is coincident and may be mistaken for convulsive hypoglycaemic attacks. Electroencephalography should be carried out in all cases in which there is the least doubt. Insulin-induced hypoglycaemia may be necessary to differentiate the two, but should be performed only under continuous E.E.G. control, with an intravenous infusion running.

(3) Emotional problems are no more frequent in adequately controlled diabetic children who understand their illness than in the general child population. The emotionally disturbed diabetic child soon recognizes that he has a useful tool in his diabetes, however, and if such a situation arises it is best discussed immediately and openly. Behaviour problems may occur in the recently diagnosed diabetic of 3 to 7 years who hates injections but refuses to cry and puts on a brave face. Again open discussion will usually resolve the problem.

(4) Dental care should be scrupulous, with regular six-monthly checks to avoid extensive caries necessitating hospital admission for multiple extractions.

(5) Obesity is an important factor at the onset in some 2% of diabetic children. In these children quite long remissions may result from simple weight reduction.

Problems Resulting from Mismanagement

These are: (1) Behaviour disturbances related to the family's ignorance of management of the condition. (2) Use of the threat of "consequences" of "poor" control in order to achieve improvement is not justified. (3) Failure to recognize the effect described by Somogyi[3] in which excess insulin administration results in hyperglycaemia and even ketonuria as a physiological response to intermittent hypoglycaemia. (4) Failure to recognize excessive dependence of a child on the parent or vice versa, the latter being a particularly resistant form of the "persistent umbilical cord syndrome." (5) Over-treatment of ketoacidosis: initial insulin requirements in childhood rarely exceed 50 units of insulin.

Further Points

Finally, what of the suggestions that a regulated diet probably has little to offer? So far as this clinic is concerned it is not yet possible to discuss long-term results, but in childhood and adolescence:

(1) Growth is normal in nearly all adequately controlled diabetic children.

(2) Infections are relatively infrequent. For example, all the 160 children attending the clinic were recently screened for urine infection and vulvitis. No cases of the former were encountered and vulvitis was met with less frequently than in a large comparable series of normal schoolgirls.[4]

(3) Hyperglycaemia and glycosuria are not "common" in the adequately controlled diabetic child. In children blood-sugar values measured routinely at each clinic visit and obtained after a wait in a laboratory for a painful thumb-prick or ear-prick appear to be of much less use than occasional blood sugars obtained by skilful venepuncture within a minute of the child learning that they are to be taken.

(4) The readmission rate for ketoacidosis is less than 2% per year.

(5) Serum total lipid, cholesterol, and lipoproteins are normal in adequately controlled diabetes and are a useful adjuvant in assessing diabetic control, especially in adolescents.

(6) Emotional difficulties are encountered no more often in diabetic children or adolescents than in the general population.

(7) Educational, athletic, and vocational achievements are within normal limits.

Conclusion

Outpatient care of the diabetic child has been somewhat idealized in this account, and even with the most stable diabetic child or teenager control will vary from time to time, depending on the prevailing social or emotional state. Similarly, all clinics will inevitably have a small proportion of individuals the social and intellectual resources of whom make it impossible to achieve the ideal. Nevertheless, this ideal should be the target for the great majority and should be successfully achieved in most.

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