

The Value of Self Monitoring of Blood Glucose

It is generally acknowledged that continuous assessment of the degree of carbohydrate control by the diabetic himself is an important part of management. This has been done by way of urinalysis of glucose. The limitations of urinalysis have been accepted because it has not been practical to monitor blood glucose as frequently or in real life situations. Recent work from 2 diabetic units in Britain indicates that self monitoring of blood glucose may soon be a practical proposition and an important contribution to the prevention of acute and even long term complications of diabetes mellitus [1,2].

Urinalysis is inconvenient. So that it represents events in the blood at a particular point in the day, a 'double voiding technique' is required; this generally means the bladder is emptied once and then a second time about half an hour later. With a test for reducing substances such as 'Clinitest', test tubes, dropper and test tablets must be available or, at best, with a glucose oxidase method such as 'Diastix', urine must be assessed with a test strip. Both of these urine tests generate false positives and false negatives. Moreover, often the most that can be concluded is that the blood glucose has exceeded the renal threshold. This is because a concentration of glucose in the urine is assessed by way of a urine test. For example, 1% is 1g glucose/100ml urine, and this will be dependent as much on urine output per unit time as glucose output per unit time. It also presumes a knowledge of the renal threshold for glucose and this is generally taken to be 10mmol/L. Few patients actually have their renal threshold for glucose defined. Even if they did, urinalysis allows no assessment of variation in blood glucose control below the renal threshold.

Single urinalyses, then, are used as an approximation of carbohydrate status at particular points in a 24-hour period. They are used as a guide for adjustment of therapy in a subsequent 24-hour period. There is no doubt that it would be better to know what was happening in the blood at those points in time. Single specimens of urine or blood, however, will not by themselves define overall carbohydrate control. To this end, 24-hour urinary glucose output and, more recently, the glycosylated haemoglobin A_{1c} are measured. Furthermore, it must not be forgotten that carbohydrate control is only one aspect of diabetic management. Energy balance, reflected in body weight, and blood lipids as risk factors for macrovascular disease, are also important.

The group at St Thomas' Hospital Medical School in London studied 64 insulin dependent diabetic patients who measured their own blood glucose concentration with 'Dextrostix' and an 'Eyetone' meter. At the General Hospital, Nottingham, 69 insulin dependent diabetics were taught to obtain their own blood glucose profiles with 'Reflotest' strips and a 'Reflomat' reflectance meter. As a result of this approach, blood glucose profiles were substantially improved throughout the day and blood glucose rarely exceeded the renal threshold. With

a much more comprehensive knowledge of blood glucose status throughout the day, it was possible, by selection from medium and short acting insulins used twice daily, to choose insulin appropriately and to produce more nearly normal and stable blood glucose concentrations. It is important to recognise that there were actually fewer hypoglycaemic episodes in association with improved carbohydrate control. Hypoglycaemia has been one of the objections in the past to attempts at normalisation of blood glucose. The reason for this concern in the past has been that, on the basis of urinalysis, it has been necessary to increase insulin dosage to deal with peaks of blood glucose in the absence of information about the troughs.

Thus, the first object of the self monitoring approach, to reduce the acute complications of diabetes, appears to have been realised. It should now be possible to design long term studies to assess the impact of truly better carbohydrate control on the long term complications of diabetes. In the meantime, it is interesting to note that in one patient managed by the Nottingham group, an 18-year-old boy with proliferative diabetic retinopathy, after 10 months of improved control, new vessels regressed and one fundus became normal.

There were surprisingly few difficulties with the self monitoring approach. One might have expected that repeated fingerpricks for blood glucose would have been disliked, but most patients preferred this to urinalysis. Simple washing of the hands was sufficient to avoid local infection. Few patients could not use the reflectance meter with the required reliability. Much should be gained when reflectance meters become miniaturised and battery operated to improve portability.

There are areas of diabetic management where self monitoring of blood glucose should be of particular value. The 'brittle' diabetic should benefit from an evaluation of periods of low and high blood glucose concentration and more relevant adjustment of insulin dosage. Where renal threshold is altered as in pregnancy or with advancing years, better control will be achieved when blood glucose is measured. It may be possible to reduce the period of hospitalisation for the pregnancy diabetic as a consequence. Pregnant diabetics were shown to benefit in both the British studies. Then, too, it may be predicted that those with emerging diabetic complications, and at special risk from inadequate control, would profit from self monitoring of blood glucose.

In these days, cost-benefit analyses are urged on doctors and patients too. It will help if the cost of reflectance meters is reduced. But it would not require many avoidances of hypoglycaemia or ketoacidosis, let alone a reduction in long term vascular complications of diabetes, to justify the purchase of a reflectance meter by the insulin dependent diabetic.

For the patients who have used the self monitoring technique, one of the most obvious benefits seems to have been an improved understanding of their condition and a greater sense of independence.

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