THE ACCEPTANCE OF HOME GLUCOSE MONITORING BY DIABETIC CHILDREN

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SYNOPSIS

Good blood glucose control in diabetics is important in minimising microvascular complications, particularly in young diabetic children who may develop complications by adulthood. Home blood glucose monitoring (HBGM) has been used successfully in adult diabetics but this is the first report in Singapore of its use in diabetic children.

12 children with insulin-dependent diabetes mellitus in the University Department of Paediatrics were taught HBGM. Their ages ranged from 4.9 to 17.2 years (mean 11.7 years). They checked their blood glucose levels before meals and before sleep. These patients were all initially on once-daily Lente insulin.

HBGM showed poor blood glucose control in 11 of the 12 patients. Adjustments were then made to their insulin regimes, using HBGM, to achieve optimum blood glucose control. 11 patients found HBGM useful and the only complaint was that of sore fingers. They felt symptomatically improved and had a better understanding of their illness after HBGM. Hence they were motivated to participate more actively in their own management.

We have therefore shown that HBGM is acceptable in diabetic children who would benefit most from good blood glucose control.

INTRODUCTION

It has been shown that blood glucose control is one of the major factors in delaying the onset of microvascular complications in diabetics (1, 2) One should therefore try to achieve optimal blood glucose control in diabetics (3) Young insulin-dependent diabetic children in particular need to be well controlled as their growth may suffer or they may develop microvascular complications by adulthood.

Home blood glucose monitoring (HBGM) has been used successfully in adult diabetics to achieve good blood glucose control (4, 5). This is the first report of its use and acceptance in young diabetic children in Singapore.

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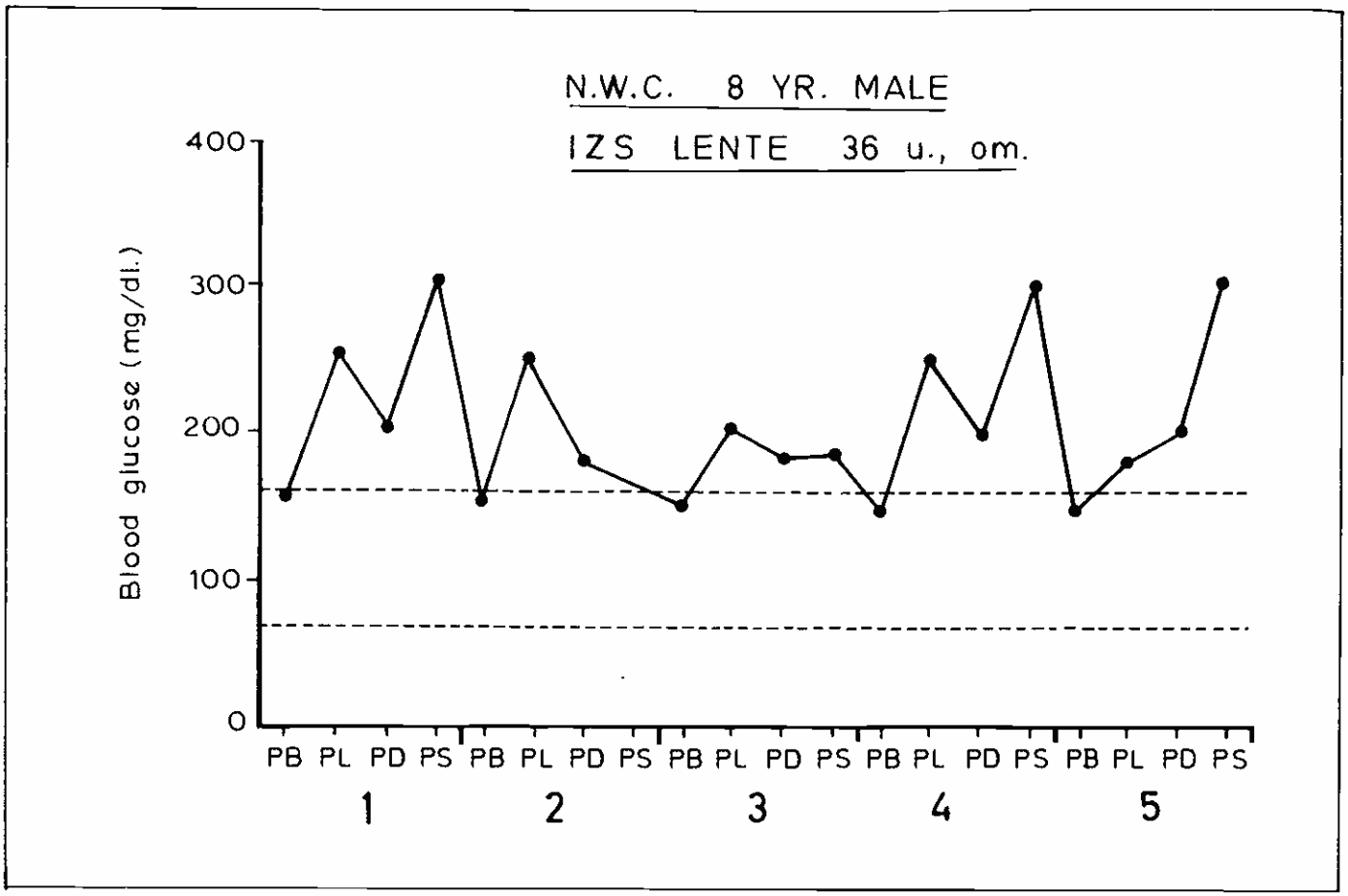

FIG. 1 THE BLOOD GLUCOSE PROFILE OVER 5 DAYS ON HBGM OF AN 8-YEAR OLD DIABETIC BOY, SHOWING WIDE VARIATIONS OF BLOOD GLUCOSE VALUES THROUGHOUT THE DAY.

MATERIALS AND METHOD

12 children with insulin-dependent diabetes mellitus in the University Department of Paediatrics, National University of Singapore, were included in the study which extended over 13 months. There were 11 males and 1 female. There were 8 Chinese, 3 Indians and 1 Malay. Their ages ranged from 4.9 to 17.2 years (mean 11.7 years). The patients included an 11-year old with deaf mutism, a 16-year old with thyrotoxicosis in addition to his diabetes, and a 17-year old with Down's syndrome, thyrotoxicosis and diabetes mellitus.

5 out of 12 patients were in secondary school, 4 were at the primary level, and there were 1 each in kindergarten, the school for the deaf, and the school for retarded children respectively. All the parents attained either primary or secondary level of education only.

The age of onset of diabetes ranged from 2.5 to 15.2 years (mean 7.1 years) and the duration of disease ranged from 2.3 to 13.5 years (mean 5.9 years). All the patients had been on once-daily Lente Insulin previously with monitoring by daily urine sugar testing and periodic outpatient blood glucose checks.

Home blood glucose monitoring (HBGM) was performed with the Ames Dextrometer and Ames Dextrostix strips, which have been shown to be reliable (6). The Autolet-Monolet system was used to obtain finger-prick blood samples. Each patient or parent was individually instructed at the diabetic outpatient clinic by - the paediatrician-in-charge, on the calibration, use and maintenance of the Dextrometer, and the technique of obtaining blood samples for the blood glucose measurements. A minimum half hour was spent each time in instructing the patient. 2 patients, the 11-year old with deaf mutism, and an 8-year old boy, stayed in hospital for a week to learn and master the technique of blood glucose monitoring. A 17-year old male with Down's syndrome and 3 young patients under 7 years of age had to have their HBGM done by either a parent or grandparent.

The patients checked their blood glucose levels before mealtimes and before sleep, with periodic checks 2 hours post prandial, at 2 a.m. and whenever they had hypoglycaemic attacks. Initially, they did their blood glucose profiles for the week on their existing once-daily Lente Insulin regimes. The insulin regimes were then changed to twice-daily Semilente injections. The patients then telephoned in weekly to give their blood glucose profiles so that insulin adjustments could be made accordingly until they achieved good blood glucose control throughout the day.

RESULTS

The period of HBGM in the 12 patients ranged from one week to 13 months (mean 6 months). The total number of blood glucose checks done per patient ranged from 28 to 299 (mean 183). One patient, the only girl in the study, performed HBGM for only a week as her blood glucose profile showed good control. The other 11 patients showed wide variations in their blood glucose levels on their existing Lente Insulin regimes, particularly evening hyperglycaemia with lower pre-lunch blood glucose values. No one showed the Somogyi effect during HBGM. There was a significant drop of mean blood glucose value from 250 mg/dl to 150 mg/dl ($p < 0.001$).

Figure 1 shows the blood glucose profile over 5 days on HBGM of an 8 year old diabetic boy supposedly well controlled on his existing insulin regime. It shows wide varia-

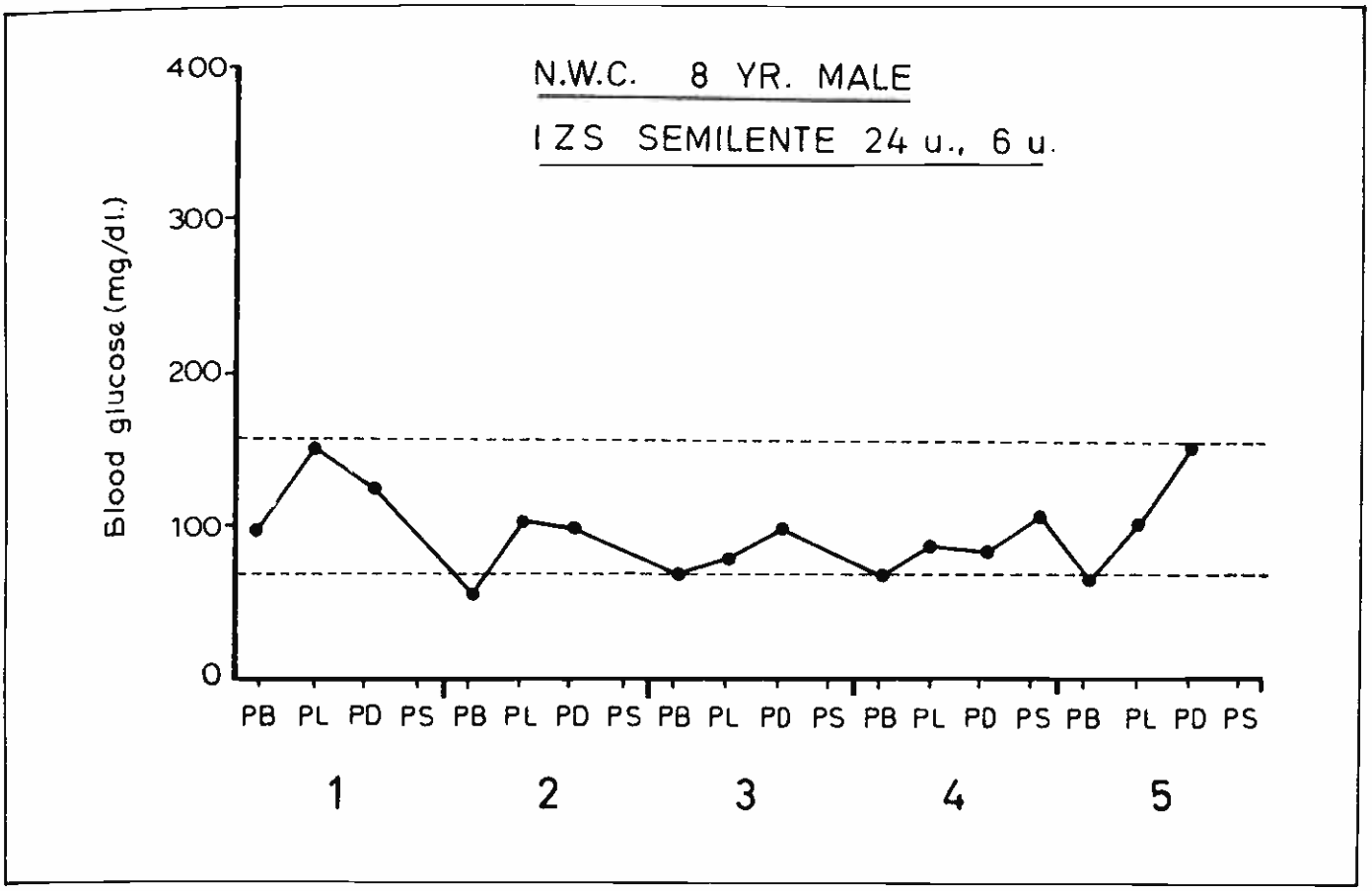

FIG. 2 THE BLOOD GLUCOSE PROFILE OF THE SAME PATIENT AS IN FIG. 1, AT THE END OF HBGM SHOWING MUCH IMPROVED BLOOD GLUCOSE CONTROL.

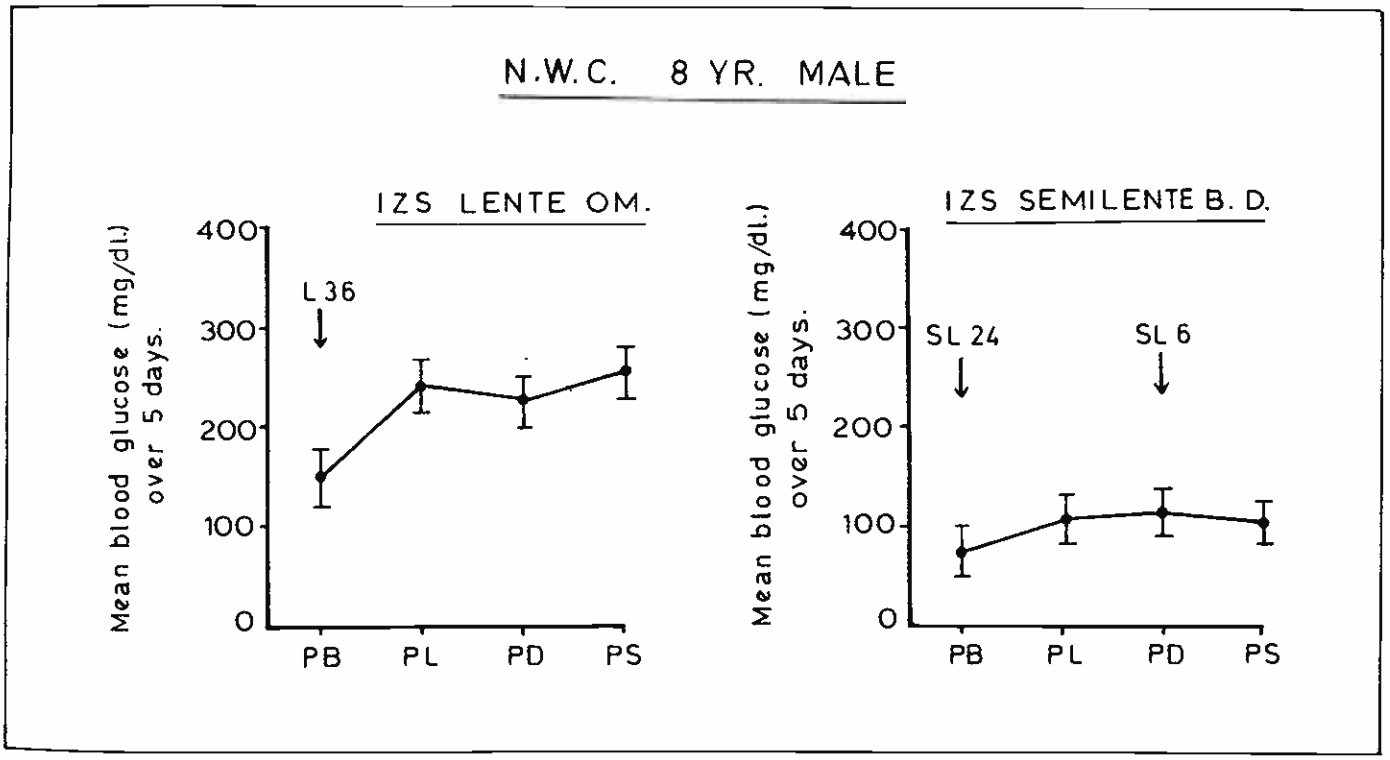

FIG. 3 THE MEAN BLOOD GLUCOSE VALUES OVER 5 DAYS OF THE SAME PATIENT AS IN FIGS. 1 and 2, ON HBGM SHOWING HYPERGLYCAEMIA IN THE LATTER PART OF THE DAY AND IMPROVED 24-HOUR BLOOD GLUCOSE CONTROL AFTER HBGM.

tions in blood glucose values throughout the day.

Figure 2 shows the blood glucose profile of the same patient at the end of HBGM when final adjustments had been made to his insulin regime to achieve optimal blood glucose control.

Figure 3 shows the mean blood glucose values over 5 days of the same patient on HBGM. It shows hyperglycaemia during the latter part of the day, and improved 24-hour blood glucose control after HBGM.

PATIENT AND PARENT REACTIONS TO HBGM

All 12 patients agreed to HBGM after some time was spent in explaining its importance in blood glucose control. 4 out of 12 patients (the 3 youngest patients under 7 years of age the 11-year old with deaf mutism) were initially hesitant but after they realised that the finger prick by the Autolet-Monolet system was not painful, they agreed to do HBGM. There were no problems encountered in learning how to perform HBGM except the 60-second timing of the blood sampel on the Dextrostix but this was overcome eventually by constant practice. The only complaint they all had was that of sore fingers but during the period of stabilisation of blood glucose, the patients were doing finger-pricks 4 to 6 times per day.

The patients felf symptomatically improved, and after HBGM they had less episodes of diabetic ketoacidosis and hypoglycaemia. They felt that they had a better understanding of their illness with HBGM. This motivated them to participate more actively in their own management.

With HBGM the patients and their parents found that they could see for themselves what their blood glucose values were like throughout the day and at the times when they experienced or suspected hypoglycaemia. In addition, advice on adjustments of insulin dose could be given over the telephone, resulting in a decrease in hospital outpatient visits required of the patients and consequently a reduction in time and money spent by the patients.

10 out of 12 patients preferred HBGM to urine sugar testing as they found the latter troublesome and messy. One patient, the 17 year old with Down's syndrome, did not like HBGM as he could not appreciate the importance of it, but his mother found HBGM to be of use.

All of the patients wished to purchase the necessary equipment for HBGM but only 2 out of 10 could actually afford to purchase their own meters.

DISCUSSION

Our study has shown the usefulness and acceptance of home blood glucose monitoring (HBGM) by diabetic children to monitor their blood glucose control. Age, race, educational status, or associated medical problems eg. deaf mutism, did not hinder the acceptance of HBGM in any way. An important factor was the time needed to teach and explain the importance and use of HBGM to the patients and their parents. They could then overcome the initial fears of the finger pricking, and the only complaint was that of soreness at the finger tips. They encountered no problems with the use of the Dextrometers and managed to fit HBGM into their daily schedules.

With HBGM, the patients found they had less symptoms, and less episodes of hypoglycaemia or diabetic ketoacidosis. They had a better understanding of their illness and management. They could now see how their insulin doses were adjusted according to their daily blood glucose profiles on HBGM, to achieve optimal blood glucose control. This encouraged them to participate more actively in their own management. 10 out of 12 patients were quite happy to continue with HBGM instead of urine sugar testing, but regrettably only 2 patients could afford to buy the Dextrometers and Dextrostix.

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