PRACTICE OBSERVED

Practice Research

Does home monitoring of blood glucose work in general practice?

R L GIBBINS, J SAUNDERS, C J ROWLANDS, J HARDING-DEMPTSTER, A J M CAVENAGH

Home monitoring of blood glucose concentrations has been associated with improved control in patients with insulin dependent diabetes.¹⁻⁴ Many such patients do not attend hospital clinics at all or do not attend often enough to benefit from the technique. This is especially so in rural areas, where general practitioners are inevitably more concerned in the management of diabetes than elsewhere. We undertook this study to examine the feasibility and efficacy of home blood glucose monitoring in general practice in cooperation with the district general hospital.

Method

The practice is rural and serves 13 500 patients over an area of 250 square miles. It is 20 miles by road to the district general hospital. None of the eight partners has a special interest or experience in diabetes. All patients with insulin dependent diabetes aged over 16 were identified from the practice diabetes register and invited to join the study. Twenty six out of 52 respondents, two were excluded on grounds of age (over 70 years), two because they were already self monitoring, and two more withdrew after further explanation, so that in all 20 patients were studied.

The practice nurse spent an hour with the consultant physician at the district general hospital for instruction in self

monitoring technique. The consultant also drew up simple guidelines on self monitoring technique and on adjustment of the insulin dose for distribution to the partners in the practice and their patients. No direct contact between the consultant and patient was planned at the outset, although advice from and referral to the consultant was available in the usual way (though not in fact used). Patients were then seen for a one hour introductory session with the practice nurse (JH-D) and a doctor (RG). After completing a questionnaire patients were examined with special attention to possible diabetic complications, including funduscopy with mydriasis and visual acuity. Venous blood samples were taken to measure full blood count and urea, electrolyte, total glycosylated haemoglobin (HbA_{1c}), and blood glucose concentrations, the last by both laboratory methods and reflectance meter. Coefficient of variation of the glycosylated haemoglobin assay was 2.2%.

Each patient was then shown how to measure blood glucose using Dextrostix and a reflectance meter (Glucometer, Ames), and had to demonstrate the technique satisfactorily before leaving with a Glucometer, instruction leaflet, Autolot, Monolot lancets, Dextrostix, and a record diary. Patients were requested to do the measurements before meals and before bed on five of the next seven days and around 3.00 am on two days. They were advised not to alter management in the first week but to see their own general practitioner with the completed diary at the end of the week. Written guidelines on adjustment of insulin dose were given to each patient. A "diabetic card" with data from the initial assessment, modelled on the antenatal cooperation card, was inserted into each patient's notes in the surgery.

Subsequent visits and the frequency of monitoring and giving advice were at the discretion of each general practitioner and patient, though it was suggested that monitoring should continue on at least two days a week with a visit to the general practitioner at least every three weeks. The diabetic card was used to record progress. Apart from encouraging patients to contact the practice nurse if problems arose, general practitioners managed their own patients entirely.

After 12 weeks patients were contacted by letter and asked to complete a final week of intensive monitoring identical with the initial week. All were then seen by R.G. for the biochemical assessment repeated, and a final questionnaire completed. Patients were then asked whether they wished to keep their meters, and if so were offered them at a reduced price.

Rupert House, Brecon, Powys

R L GIBBINS, MB, FRCS

C J ROWLANDS, MB, research assistant

J HARDING-DEMPTSTER, MB, practice nurse

A J M CAVENAGH, MB, general practitioner

Medical Unit, Nevill Hall Hospital, Aberystwyth, Gwent

J SAUNDERS, MD, MRCP, consultant physician

Correspondence to: Dr R L Gibbins, Maes-y-Coed, Builth Wells, Powys.

SUBJECTIVE

The initial questionnaire showed that 13 out of 20 patients thought that their diabetes was adequately controlled and 15 were not worried about their diabetes. Eleven were unhappy with urine testing as an index of control, 15 expected to prefer blood testing, and 14 had heard about home monitoring before the study, mostly through the district general hospital and the British Diabetic Association. The final questionnaire showed a self estimate of improved understanding of

FIG 1—Glycosylated haemoglobin (HbA_{1c}) before and after three months of home blood glucose monitoring.

diabetes in 16; 19 preferred blood to urine testing and the reasons given were, in ranking order, accuracy, ease of technique, convenience, and speed; 14 thought that their diabetes was better controlled, though mild hypoglycaemic episodes occurred more often in five; 13 had sore fingers, though none bad enough to stop using the technique; 14 said that they would buy a meter at cost price (then approximately £200). All but one thought that general practitioners should be able to prescribe Dextrostix. The general level of awareness about diabetes and its complications improved among doctors, nurses, receptionists, and patients.

Discussion

Improved control in a group of patients with insulin dependent diabetes was achieved in association with home monitoring. This has been shown in several studies in hospital.¹⁻⁴ Some workers have questioned whether the improvement is due to home monitoring or to the greater contact between doctor and patient,⁵ and further surveillance of these patients should be undertaken. The general level of awareness about diabetes and its complications improved among doctors, nurses, receptionists, and patients.

might also have been responsible for the improved control observed in our study, but the results show an appreciable improvement in control even when patients in whom this occurred are excluded. Patient selection in this study was based on willingness to participate—no participation was offered to all patients with insulin dependent diabetes in the practice—not on the desirability and practicability of improving control. It is therefore hardly surprising that not all patients improved. Overall diabetic control in the group was similar to that in a random group of 16 patients in the practice who had been studied earlier (unpublished data), as judged by a mean HbA_{1c} of 11.5%. Previous studies, however, have selected patients on the basis of demonstrated need for improving control, making successful outcome more likely.¹⁻⁴

This study is the first in which the effectiveness of blood glucose monitoring has been assessed in general practice. No attempt was made to compare the different systems available; the wealth of published evidence¹⁻⁴ suggests that all are comparable and all have advantages and disadvantages. Much of the previous work on diabetes in general practice has been carried out by general practitioners with a special interest in, or experience of, the disease. This was not so in our study, which makes the improved control achieved particularly gratifying, since 16 out of the 20 patients were already attending consultant clinics for their diabetes, 13 of them diabetic clinics.

Many hospital diabetic clinics have drawbacks, such as long waiting times, lack of continuity of care, and short consultation times, which greatly reduce their effectiveness. Several ways of tackling these problems have been suggested.¹⁻⁴ We are not suggesting that patients with insulin dependent diabetes are best looked after exclusively in general practice: the number of patients that we studied was small, and over the short duration of a special study interest is likely to be great. Secondly, an improvement from "poor" to "moderate" control as seen in our patients still leaves much to be desired, but it shows nevertheless that blood glucose monitoring at home is feasible in general practice. We think that it is unreasonable that blood glucose testing strips are available only from hospital clinics. In rural areas, in particular, patients are often reluctant or unable to make frequent visits to hospital clinics so that the inability of the general practitioner to prescribe blood glucose testing strips deprives such patients of the benefits of this technique.

If blood glucose monitoring is to be offered in general practice two essential ingredients are a well motivated practice nurse and an efficient registration and recall system for diabetic patients. An unforeseen bonus in our study was the increased awareness of diabetes and its problems among staff and patients, and discussion continues on ways to improve diabetic care. This will include follow up studies of this group of patients to discover whether the improvement achieved is maintained with less intensive supervision.

Conclusions

The feasibility and effectiveness of home monitoring of blood glucose concentrations in rural general practice were assessed over three months with a group of 20 patients with insulin dependent diabetes. Mean (SEM) glycosylated haemoglobin improved from 11.6 (0.4)% to 10.7 (0.3)%. Mean (SEM) blood glucose concentrations over initial and final weeks of intensive monitoring improved from 10.3 (1.0) mmol/l (186 (18) mg/100 ml) to 8.4 (0.7) mmol/l (151 (12.6) mg/100 ml). Patients generally preferred blood to urine testing, and most chose to keep their monitoring equipment. With appropriate organisation, most group practices should be able to offer this service. General practitioners should be able to prescribe strips to test blood glucose concentrations.

We are grateful to all partners and staff in the Brecon group practice for their cooperation and to Ames Ltd for equipment and record cards. RLG receives financial assistance from the Nevill Hall Thrombosis and General Research Fund and the Claire Wand fund.

Twelve men and eight women participated, aged 16 to 68 years (mean 44 years). Thirteen attended hospital diabetic clinics, while four were not under consultant supervision. Thirteen were receiving twice daily short and intermediate acting insulins and the remaining seven received various regimens. Mean duration of diabetes was 18 years, range 2-38. Student's *t* test was used in statistical analysis.

Results

CLINICAL

No abnormalities were found on general examination or routine screening tests except for one raised blood urea concentration, for which consultant advice was sought, and one urinary tract infection, which was successfully treated. Evidence of previously undiagnosed diabetic retinopathy was found in two patients, both with background changes. Three patients had mild neuropathic changes and five had evidence of vascular disease, but without trophic changes. Mean (SEM) body weight was 73.8 (2.6) kg (range 52-91 kg) and was unchanged at the end of the study at 73.9 (2.5) kg (range 51-92 kg). By the end of the study three additional patients were receiving twice daily short and intermediate insulins, and there was a change in total daily insulin dosage of more than 10 units in a further four patients.

BIOCHEMICAL

The relation between random venous blood glucose concentrations estimated by glucometer and in the laboratory is shown in fig 1 ($r=0.98$, $p<0.001$). Mean (SEM) random blood glucose concentrations fell from 9.2 (1.1) mmol/l (165 (20) mg/100 ml) at the start to

FIG 1—Relation between random venous blood glucose concentrations estimated by glucometer and in the laboratory is shown in fig 1 ($r=0.98$, $p<0.001$). Mean (SEM) random blood glucose concentrations fell from 9.2 (1.1) mmol/l (165 (20) mg/100 ml) at the start to

8.5 (1.3) mmol/l (153 (23) mg/100 ml) at the end of the study. This was not a significant difference. Sixteen patients had satisfactory diary records for analysis. Mean blood glucose concentrations for the initial and final weeks were calculated for each patient. The mean (SEM) of these means improved from 10.3 (1.0) mmol/l (186 (18) mg/100 ml) to 8.4 (0.7) mmol/l (151 (13) mg/100 ml) ($p<0.001$) (fig 2). HbA_{1c} before and after monitoring was obtained in 19 patients; one sample went astray in the laboratory. Initial mean (SEM) HbA_{1c} was 11.6 (0.4)%, falling to 10.7 (0.3)% ($p<0.001$) (fig 3). If the three patients whose regimens were changed to twice daily short and medium acting insulins are excluded the mean (SEM) initial and final week's blood glucose concentrations are 9.9 (1.0) mmol/l (178 (18) mg/100 ml)

and 8.1 (0.6) mmol/l (146 (11) mg/100 ml) (0.02- $p<0.001$) respectively and the mean (SEM) HbA_{1c} 11.6 (0.5)% and 10.8 (0.4)% (0.02- $p<0.01$) respectively. Four patients showed a fall in HbA_{1c} greater than 2%.

FIG 2—Mean home blood glucose concentrations during first and final weeks of study. Conversion: 5.17 mmol/l = 100 mg/100 ml.

Table 1 shows that improvement was largely from "poor" control (HbA_{1c}>12%) to "moderate" control (HbA_{1c} 10-11.9%). In two patients pronounced discrepancies between mean blood glucose results and HbA_{1c}, together with individual knowledge, suggested changes on the diary record. Table 11 shows that age did not reflect the ability to benefit from home monitoring, the same improvement being seen in the groups under and over 40 years of age. A weak correlation was seen between random blood glucose concentrations and HbA_{1c} ($r=0.45$, $p<0.05$).

TABLE 1—Change in HbA_{1c} in 19 patients

HbA _{1c} (%)	Initially	Finally
<8 (excellent)	1	1
8-9 (good)	4	10
10-11 (moderate)	10	4
>12 (poor)	6	4

TABLE 11—Response of different age groups

	<40	40-60	>60
No. of patients	11	6	11
Initial mean (SEM) HbA _{1c} (%)	11.1 (0.6)	11.6 (0.6)	11.0 (0.4)
Final mean (SEM) HbA _{1c} (%)	10.4 (0.6)	10.8 (0.4)	10.8 (0.4)
Improvement (%)	0.9	0.8	0.8

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Image of General Practice

Me and the general practitioners

NICK ROSS

I suffer from an allergy, and always have, to queuing. But you need patience to be a patient.

Overcoming the laws

There's the Receptionists' Law to overcome to start with. According to this canon, when you telephone for an appointment you have to wait while the receptionist copes with someone queuing before her at the surgery, and when you queue before her at the surgery you have to wait while she copes with someone on the phone.

So you queue to book, and on arrival you queue to prove your presence before you queue to see the doctor. This all presumes that the general practitioner's time is more precious than my own, and I suppose to him (or her) it is. But not to me. This brings us to the second law, the Law of Physics, which is ingenious. According to this: waiting for the doctor cuts down waiting for the doctor. For queuing deters the likes of me from seeking medical advice, and by cutting down the numbers seeking medical attention it reduces waiting times.

Then there's the Law of Medical Confidentiality. As the queue breathes down your neck the receptionist wants to know the reason for your visit: "I've come about my genitalia."

"What's that? Can you speak up?"

If, though, you are determined then after five or 10 minutes on the telephone, after travelling, waiting five minutes to see the

receptionist and what seems like an hour of embarrassment while she takes notes—sometimes she doesn't bother taking notes, she was simply curious it seems—and then 20 minutes reading out of date women's magazines you are admitted to the inner sanctum. Here you encounter the fourth and fifth laws, those respectively of Tests and Specialists. These take account of the fact that since over the counter remedies can now resolve most simple ailments, you only queue to see the doctor over complex ones. And complex ones need tests to find out what they are, and specialists to overcome them. More queuing.

Don't get me wrong. I don't at all begrudge the medical profession for all this waste of time. Some of my best relatives are doctors, and I'm well aware of the Patients' Law as well. According to this, if you can get treatment conveniently at any time you want then you don't bother to turn up at the time you say you will, which wastes the doctor's time.

Image not important

But set against the inconvenience of seeing a general practitioner, all other of my attitudes towards them pale into insignificance. For example, I really don't care how he or she is dressed, though I suspect if they wore white coats I'd naturally assume they were recently qualified and needed the status that white coats confer.

Sitting behind a desk is useful status too, of course. Now that the professions have taken over from the aristocracy desks seem to have replaced thrones, and they're certainly much more useful for storing pharmaceutical company giveaways. I suppose I might be curious about a general practitioner without a desk; where would he or she put the prescription pad?

As for the appearance of the consulting room, well again I'm not fussy. Cleared or cluttered, old or new, I don't care a fig. I

London NW5

NICK ROSS, television presenter

Correspondence to: 38 Willes Rd, London NW5 3DL.