A COMPARATIVE STUDY OF BLOOD TEST AGAINST URINE TEST TO MONITOR THE DIABETIC SUBJECTS

Dr. K. SURESH KANNA
Associate Professor, Bharathiyar College and Technology,
Karaikal, Puducherry state, India

ABSTRACT

A distinguish of visually observed with glucometer strips against urine testing is reported in an unselected group of 19 diabetic subjects in relation to the degree of control achieved and to its acceptability. The degree of control was at least as good after six months. Blood glucose monitoring at home (mean blood glucose 9.3 ± SEM 2.8 mmol/l, mean 24 hour glucose excretion 13 ± SEM 168 mmol/l) as after six months. Urine test (mean blood glucose 140 ± SEM 4.1 mmol/l, mean 24 hours glucose excretion 140 SEM 96 mmol/l). [1] Home blood glucose monitoring was preferred either alone or in conjunction with urine testing in most cases. It is becoming clearer that the long term complications of diabetes mellitus are related to the degree of control achieved and that in adults this can be improved by regular home monitoring of blood glucose estimations. A recent review article advocated the use of such monitoring in subjects but no long term controlled studies comparing blood with urine monitoring in relation to the degree of control possible or the acceptability of this technique have been reported.[2] Most surveys of home blood glucose monitoring have used reflectance meters, but this has been questioned on grounds of expense, clumsiness, and because they may induce a false sense of accuracy. We did a crossover trial in subjects to compare the accuracy and acceptability of conventional urine testing with home blood glucose monitoring, without the use of reflectance meters.

INTRODUCTION

There are two different tests your doctor can use to measure your blood glucose to determine if you have pre-diabetes or diabetes: the fasting plasma glucose test (FPG) or the oral glucose tolerance test (OGTT). [3] In general, it is recommended that any blood test that is outside the normal range be repeated on a different day to confirm the diagnosis. The American Diabetes Association recommends the FPG because it is easier, faster, and less expensive to perform.[5] The FPG test is a blood test that determines the amount of glucose (sugar) in the blood after an overnight fast (not eating for at least 8 hours). [6] A fasting blood glucose level between 100 and 125 mg/dl means a person has pre-diabetes. A fasting blood glucose level of 126 mg/dl or higher means a person has diabetes.[7] A urine test may be given as part of a routine check-up. A laboratory may test your urine for the presence of glucose and ketones in the urine.[8] If either are present in the urine, it could mean that you are not producing enough insulin. Urine ketone testing is most often necessary in people with type 1 diabetes who have blood sugar levels over 300 mg/dl, who are sick, or who have symptoms of diabetic keto acidosis, an acute complication of diabetes.[9] Urine tests for glucose were used in the past to test for and monitor diabetes, but they aren’t as commonly used anymore. In order to diagnose diabetes more accurately, a doctor will typically rely on a blood test. Blood tests are more accurate and can measure the exact amount of glucose in the blood. The Study was designed to assess the comparison with blood test and urine tests.

MATERIAL AND METHODS

The present study was analysed with selective diabetic subjects from the laboratory of JJ Health care Clinic & Hospital, & Indian lab Karaikal District, and South India. This analysis was carried out with Twenty five diabetic subjects between the ages of 30 and 50 with median of 40 years attending Outpatients. They were asked to take part in the trial for a one year period. They were selected from the hospital diagnostic index on the basis of age and convenient access to the centre for monthly follow up. Five of these did not co operate to take part in this study. one was already on blood glucose testing and was not prepared to revert to urine testing for six months; one was not prepared to carry out any form of regular testing; one a female subject of 40 years, was afraid
and one had recently started on twice daily insulin and was not prepared to accept yet more needles. Two patients were excluded for their personal reasons. All testing was carried out in the patient's home. Patients were randomly allocated to an initial period of five months' blood or urine testing, followed by a similar period on the alternative form of testing. At the start of the trial each child and his or her parents were given a short talk about the nature of diabetes, the importance of diabetic control, and the technique of blood testing. At the beginning of blood glucose testing they were encouraged to continue with urine testing as well for about a week to gain confidence in the new tests. Blood glucose was estimated twice each day using Dextrostix and making a comparison with the colour code on the side of the bottle. Subjects were asked to vary the timing of the tests, but always to measure them before meals and record their results on a graph, so that over a month a glucose profile would be obtained. Urine was tested in the conventional way twice a day and double micturition was encouraged. Patients were seen monthly throughout the trial in the adult outpatient clinics, in their own homes. Dosages and on four occasions types of insulin were changed as indicated by the previous month's results and dietary advice was given. The degree of control achieved was assessed on study days, at initially and twice at the end of each form of testing by the measurement of a filter paper glucose profile, 24 hour urine glucose excretions, and glycosylated haemoglobin concentrations. The subject's attitude to testing was assessed by a structured interview carried out. The study was approved by the health district ethical committee.

**STATISTICAL ANALYSIS**

Statistical analysis was done using suitable statistical tool. Data was estimated on excel sheet and analysed statistically. Quantitative data was summarized in the form of MEAN ± SD and differences in mean of both the groups were analyzed using Student’s unpaired t-test. The P value <.05 was taken as significant. Association was found by Pearson’s Correlation.

**RESULTS**

Of the 22 subjects one only—an 41 year old male subject of borderline subnormal of the delicate laboratory of JJ Health care Clinic & Hospital, Karaikal District, and South India. The subjects—did not complete the trial. He failed to carry out the study day tests, but he is now using home blood glucose testing by choice and achieving very good control as a result. During this trial, one patient required admission for keto acidosis precipitated by an attack of tonsillitis. This is clearly explained by study design.

**CONTROL SUBJECTS ASSESSMENT**

In the Table 1, the results of the study day tests are shown. In the pilot study assessment the 2 groups of patients are comparable. At the end of the project all the parameters were reduced and since none of the patients had appreciable hypoglycaemia this suggests an improvement in control. The greatest mean improvements in the parameters occurred after 6 months of blood testing. None of these changes achieved statistical significance at the P<0.05 level though the improvements in the mean blood glucose values and the urine glucose concentrations approached this. [10] Very marked changes in diabetic control were noted in response to social problems such as the impending parental separation in two subjects and the detection of a breast lump in the mother of another. The degree of motivation of the subjects in the group was varied. The better motivated patients achieved the better control. The patients were asked which type of testing they preferred 25 subjects preferred blood testing alone, none preferred
urine testing alone, and two preferred a mixture of the two reasons for preference. Many found the new technique easier to carry out and 12 mentioned that they felt more in control of their diabetes. [11] The ability to carry out spot checks of their blood glucose concentrations was particularly useful in cases of hypoglycaemia. The Dextrostix before bed could either reassure or indicate the need for further carbohydrate. Fifteen subjects found difficulty in obtaining blood samples, and 9 complained of sore fingers. Patients often used sites other than their index fingers but with time this became less of a problem. Only 5 had difficulty in interpreting the colour of the Dextrostix but this could be overcome by the use of a meter.

ASSESSMENT OF FINAL FOLLOW UP

At the end of the trial the patients were asked which form of testing they would like to continue—9 wanted to continue with blood testing alone, 2 wanted to continue with urine testing alone, and 12 wanted to continue with a combination of the two methods. They have broadly followed this pattern at recent follow up were explained in Table 1

<table>
<thead>
<tr>
<th>PILOT STUDY TO FIRST MONITORING</th>
<th>PHASE 1</th>
<th>PHASE 2</th>
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<td>GROUP 1</td>
<td>AFTER 6 MONTHS URINE ANALYSIS</td>
<td>PILOT AFTER 6 MONTHS BLOOD ANALYSIS</td>
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<tr>
<td>Mean of filter paper glucose profile (mmol/1)</td>
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<td>12.1</td>
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<td>Mean change ±SEM</td>
<td>-1.2±3.2</td>
<td>-2.9±2.5</td>
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<td>24 hour urine glucose (mmol/l)</td>
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<td>Mean change ±SEM</td>
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<td>118±231</td>
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<td>Glycosylated haemoglobin HbA1c, g/dl</td>
<td>10.0</td>
<td>7</td>
</tr>
<tr>
<td>Mean change ±SEM</td>
<td>-0.6±2.3</td>
<td>-0.9±1.4</td>
</tr>
</tbody>
</table>

Table 1 – pilot and follow up of diabetic subject results

SUMMARY AND DISCUSSION

Evidence that the degree of diabetic control is related to the long term micro vascular complications has been shown prior. If one accepts this, diabetic subjects, in view of their longer exposure to the disease, are the most likely to benefit from tight control. These subjects are often difficult to control because of their variable energy expenditure, dietary indiscretions, changes in insulin requirements in relation to growth, and the emotional problems of adolescence. It is a clinical observation that subjects find urine testing unpleasant and tedious [12]. But these trials were retrospective and lacked controls. The results of a controlled trial in a well motivated group of pregnant women concluded that there might be a place for blood monitoring in some patients.9 Control was not improved with blood monitoring and with adequate attention to detail extremely good results could be achieved with urine testing. These trials all used reflectance meters, but an assessment of the patients' accuracy in reading Dextrostix showed that this method compared well with laboratory glucose analyses. In this study the possibility of machine error was also recognised. Machines are sensitive to the minor abuses to be expected in the home, and this problem, combined with their price (£70 minimum) and inconvenience, prompted us to investigate the possibility of home blood glucose monitoring without meters.[13] Test to test variation in the day to day measurement of blood glucose concentrations is often large and one needs to
know whether an individual value is high, low, or about right. The results of this trial suggest that home blood glucose monitoring with visually read Dextrostix may lead to better control of diabetes in some patients. The good results achieved in this group are comparable to those achieved in other series of closely supervised diabetics suggesting that any further improvement with the use of meters would be small, and it is doubtful whether the expense could be justified.[14] The results of the attitude testing were contrary to the expectations of many of the doctors looking after the subjects, since all the subjects preferred blood testing either alone or in combination to urine testing alone. After the trial the majority continued with blood testing at least some of the time. A notable feature during the trial was the improvement in the patients' understanding of their disease.

CONCLUSION

The effectiveness of this system to improve diabetic control depends on several factors, the skill of the doctor to advice on its use, the ability and motivation of the patient in using the technique, and the attention paid to dietary advice and insulin administration. We suggest that blood monitoring is an aid to diabetic control, and that adult diabetics should be instructed in blood and urine monitoring and be allowed to use either or both. This approach should lead to a greater number of adult diabetics finding tight control easier to achieve and result in a reduction in the prevalence of micro vascular complications.

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REFERENCES