Spurious hyperglycaemia—a hazard of finger prick blood glucose estimation

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SUMMARY

Two diabetic patients presented in coma to the accident and emergency department. Although they were hypoglycaemic, the initial blood glucose reagent strip readings were high. We postulate that glucose contamination of their fingers occurred and resulted in spuriously high readings. A small survey highlights the problems resulting from such contamination. Correct handling of blood glucose reagent strips is stressed and we advise venous blood samples in all diabetic emergencies presenting to the accident and emergency department.

INTRODUCTION

The rapid diagnosis of hypoglycaemic coma has been facilitated by the use of blood glucose reagent strips, but complete reliance on this method can lead to errors. We report two cases in which errors occurred and offer a possible explanation.

CASE REPORTS AND INVESTIGATION

A 67 year old diabetic woman who was known to have frequent insulin reactions was found on the floor mumbling incoherently. Her husband struggled for 2 h to give her glucose and water. She was brought to hospital and on arrival was unconscious but could respond to painful stimuli. She was flushed and sweating. Her pulse was regular the rate was 72/min. The blood glucose was measured by Dextrostix (Ames) using an Ames glucometer on blood obtained by finger prick. The result was 13.0 mmol/l. This conflicted with the clinical diagnosis of hypoglycaemia and the test was repeated with Dextrostix using venous blood. On this occasion the result was 0 mmol/l. The

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laboratory reported a result of 1.5 mmol/l on another venous blood sample taken at the same time. She was treated with intravenous glucose and rapidly recovered.

A 74 year old man, a diabetic for 36 years, had become increasingly demented over number of years. For one week he had been more confused. He wandered from home and collapsed in the street. He was taken to hospital and on arrival his eyes were open but he was hypotonic and unresponsive. He was flushed but not sweating and his pulse was regular the rate being 80/min. His blood glucose was estimated to be 44 mmol/l on a finger prick sample using BM-Test glycaemie 20-800 (Boehringer) reagent strips. A venous sample taken on admission was estimated to be 0.5 mmol/l by the laboratory. Unfortunately before this result was known the patient was given 20 U of neutral insulin intramuscularly and a 0.9% saline infusion was started. He had a decerebrate posture and was deeply unconscious. At this time a venous blood sample tested with a BM-Test strip gave a reading of 0. He was given intravenous Dextrose and regained consciousness in 7 h.

The clinical features and 'bedside biochemistry' in these cases were conflicting and in the latter the wrong treatment was given on the basis of the blood glucose measured using a finger prick sample. We postulate that the discrepancy between the venepuncture and finger prick blood glucose resulted from contamination of the patients' fingers during attempts to give oral glucose.

To test this theory five finger prick blood glucose estimations were performed within 10 min on each of ten subjects. The first specimen was taken from an uncontaminated finger cleaned with isopropyl alcohol; the second from a finger dipped in Lucozade (20% glucose solution) and allowed to dry; the third from a finger dipped in Lucozade, allowed to dry, then cleaned with isopropyl alcohol; the fourth from a finger dipped in 20% sucrose solution and allowed to dry; the fifth from a sucrose contaminated finger.

Table 1

Finger treatment	Patients									
	1	2	3	4	5	6	7	8	9	10
Cleaned with isopropyl alcohol	5.9	6.1	2.5	7.0	7.4	2.5	2.3	4.5	4.8	7.8
Dipped in Lucozade and allowed to dry	19.6	> 22	> 22	> 22	> 22	> 22	> 22	> 22	> 22	12.6
Dipped in Lucozade, allowed to dry then cleaned with isopropyl alcohol	8.3	17.0	> 22	14.8	12.4	5.3	> 22	21.0	16.0	5.6
Dipped in sucrose solution and allowed to dry	4.9	6.4	6.0	4.6	2.4	3.7	4.9	2.0	3.0	3.8
Dipped in sucrose solution, allowed to dry then cleaned with isopropyl alcohol	5.8	4.1	2.2	6.4	1.9	2.4	2.2	2.7	2.8	4.4

Blood glucose (mmol/l)

Fig. 1

cleaned with isopropyl alcohol. The blood glucose of each sample was assayed with a Dextrostix reagent strip used in a Glucometer reflectance meter (Ames). The results are shown in Table 1 and Fig. 1.

DISCUSSION

Our study showed that contamination with a glucose solution caused an extremely high false result when a finger prick blood sample was tested with Dextrostix. Even cleaning with isopropyl alcohol did not entirely eliminate the error. Some skins were easier to clean than others. Sucrose contamination did not affect the blood glucose estimation as Dextrostix are impregnated with glucose oxidase and the disaccharide does not activate this enzyme.

Grazaitis and Sexson (1980) found that cleaning the skin with isopropyl alcohol could cause a falsely high blood glucose result using Dextrostix reagent strips. They therefore recommended that after preparing the skin before finger prick excess alcohol should be wiped away and the first drop of blood discarded. This advice does not currently appear on the Ames product information sheet enclosed in each box of Dextrostix, although it is stressed in a personal communication from the Company. This effect of isopropyl alcohol was not apparent in our study. Skin contamination with glucose is most likely to occur when attempts have been made to treat a patient with suspected hypoglycaemia. It is unlikely that errors of this type will affect the many finger prick blood glucose estimations done daily to check diabetic control. However, all personnel should follow the manufacturers' directions for handling blood glucose reagent strips. In accident and emergency departments venous blood should be taken in all diabetic emergencies. Samples can be tested using a test strip and also saved for later laboratory examination. Hypoglycaemia is a medical emergency and treatment must not be delayed pending

laboratory confirmation. The usefulness and accuracy of blood glucose reagent strips is well established but awareness of the hazard of skin contamination may prevent potential disaster.

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REFERENCE

Grazaitis D. M. & Sexson W. R. (1980) Erroneously high Dextrostix values caused by isopropyl alcohol. *Paediatrics* **66**, 221-3.

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