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Short reports

Comparison of blood glucose test strips in the detection of neonatal hypoglycaemia

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SUMMARY Blood glucose levels were estimated in 101 neonatal blood samples using three glucose test strip methods and the results compared with those from a laboratory. BM-test-glycemie 20–800 test strips and Reflotest-hypoglycemie test strips gave a rapid and reliable estimate of blood glucose level in the range 0–8 mmol/l (0–140 mg/100 ml). Dextrostix test strips tended to overestimate all blood glucose levels.

It is important to detect hypoglycaemia in neonatal practice,[1 2] and for any infant at risk a rapid and reliable method for measuring blood glucose concentration is essential. Blood glucose test strips offer a rapid cotside test. The newer test strips, BM-test-glycemie 20–800 and Reflotest-hypoglycemie, have not been evaluated in the newborn. This study was undertaken to test the reliability of these and to compare them with Dextrostix test strips, already widely used in neonatal units.

Patients and methods

Forty babies were chosen in whom sequential blood glucose estimations would normally have been made. On some occasions a 200 µl sample was obtained into a heparinised tube from a heelprick. A total of 101 samples was studied and tests were performed within half an hour of collection. Twenty-five babies were in the Special Care Baby Unit and 15 on the routine postnatal wards. The majority were small for gestational age. Two were infants of diabetic mothers. Twenty were preterm, of which 8 were also small for gestational age and 6 were twins. The range of birthweights was 900 to 4500 g. Glucose was estimated by the following methods in sequence on each sample: (1) Dextrostix (performed on the ward and read by eye under fluorescent lighting). (2) BM-test-glycemie 20–800 (performed on the ward and read by eye under fluorescent lighting). (3) Reflotest-hypoglycemie. (4) Urgent laboratory glucose estimation on the remainder of the sample after transfer to a fluoridated bottle.

Dextrostix (Ames Co.) is a strip containing glucose oxidase, peroxidase, and a chromogen in a test pad. The colour generated provides a semiquantitative result if compared visually with the reference colours, interpolating between them as necessary. The range is 1·4–13·9 mmol/l (25–250 mg/100 ml).

BM-test-glycemie 20–800 (Boehringer Mannheim) is a similar strip that uses the same enzymes, but the test pad is smaller and has two separate areas generating different colours. The range is 1·1–44 mmol/l (20–800 mg/100 ml).

Reflotest-hypoglycemie (Boehringer Mannheim) is similar to BM-test-glycemie but with a single chromogenic area. It gives a quantitative reading if used in combination with a Reflomat (Boehringer Mannheim), a twin beam reflectance photometer. The range is 0·55–8·3 mmol/l (10–150 mg/100 ml).

In the laboratory, blood glucose concentration was measured by either of two methods. The Technicon II autoanalyser uses glucose oxidase, peroxidase, and chromogen and separates glucose from plasma by dialysis. The Yellow Springs Glucose Analyser uses glucose oxidase and a peroxide electrode. The two methods agree closely on daily quality control checks.

The order in which Dextrostix and BM-test-glycemie were performed was varied at random. They were both performed by the same observer before the other results were known.

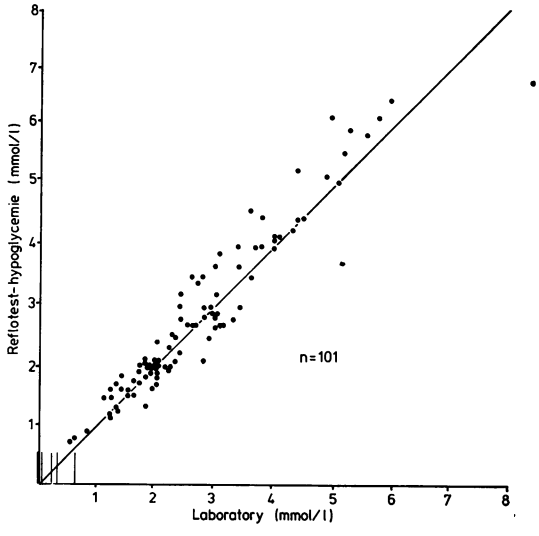
Results

The Dextrostix, BM-test-glycemie, and Reflotest readings were plotted separately against the corresponding laboratory values (Figs 1, 2, and 3). It can be seen that Dextrostix tends to overestimate the blood glucose level. In five cases in this study Dextrostix failed to diagnose a laboratory level of less than 1·1 mmol/l (20 mg/100 ml) and in many instances it failed to indicate borderline hypoglycaemia. BM-test-glycemie and the Reflotest system both give a closer agreement with the laboratory value than Dextrostix. In no case did

either fail to detect actual or borderline hypoglycaemia.

Discussion

We feel that Dextrostix is inaccurate for two principal reasons. Firstly, the colour continues to develop after the blood is washed off;[3] the need for two simultaneous operations, washing off the blood and interpreting the colour, makes this a source of error. Secondly, the high haematocrit blood of neonates may not wash off easily and may obscure the colour reaction.



Conversion SI to traditional units: 1 mmol/l ≈ 18 mg/100 ml.

Fig. 1 *Comparison of Reflotest and laboratory estimations of blood glucose concentration. Vertical bars represent results where the Reflotest reading is less than 0·55 mmol/l.*

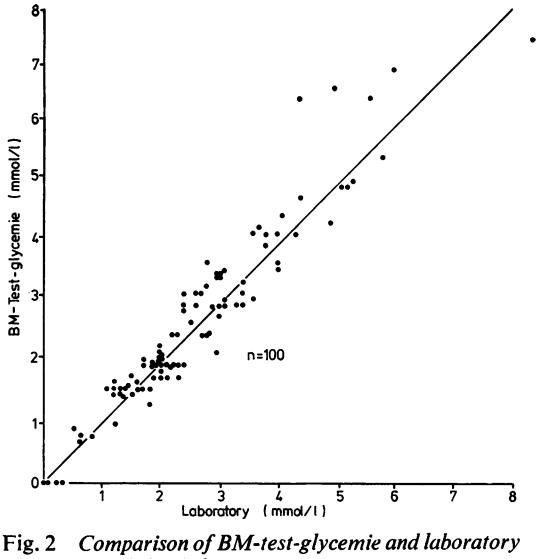


Fig. 2 *Comparison of BM-test-glycemie and laboratory estimations of blood glucose concentrations.*

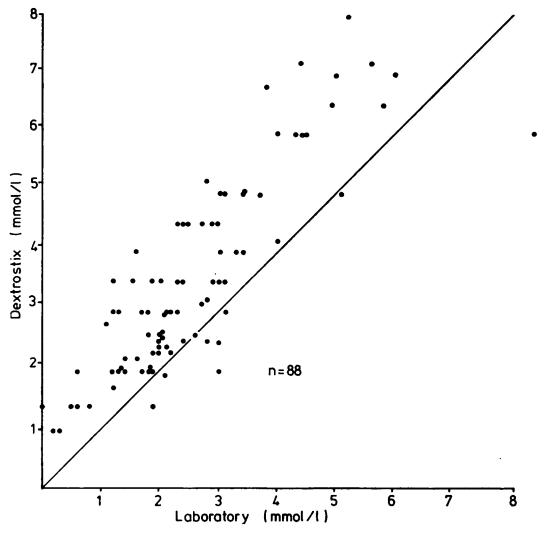


Fig. 3 *Comparison of Dextrostix and laboratory estimations of blood glucose concentration.*

It has been found[4] that if the haematocrit is artificially increased in blood from adults there is a falsely low Dextrostix and, to a much lesser extent, Reflotest reading. If this is also true of the physiologically high haematocrit blood of neonates, it would further increase the discrepancy we found between Dextrostix and the laboratory.

The BM-test-glycemie and Reflotest strips have several possible advantages. Blood is wiped off leaving a clean unobscured colour which is interpreted after a further minute so that the two operations are not simultaneous. The test area is small, requiring a small drop of blood. The test area is divided into two in the case of BM-test-glycemie, each turning a different colour, which permits a more accurate interpretation. There is little change in the colour in the few seconds after the correct reading time, so that error due to incorrect timing is less likely than with Dextrostix.[3]

We suggest that BM-test-glycemie be used routinely and, if available, the Reflotest-Reflomat system be used to confirm any value found to be low. For hypoglycaemic neonates, when falsely high estimation of blood glucose could lead to treatment being withheld, the Boehringer-Mannheim test strips provide a reliable and rapid result and may

obviate the need to send blood samples to the laboratory.

We thank Dr L Stimmler for permission to study his patients and Boehringer Corporation (London) Limited for supplying BM-test-glycemie and Reflotest strips.

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Effects of fresh frozen plasma infusions on coagulation screening tests in neonates

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SUMMARY Infusion of fresh frozen plasma to 23 immature infants with respiratory distress syndrome produced full correction of prothrombin time and activated partial thromboplastin time in only 7. Improvements in coagulation studies failed to correlate with gestational age or with the initial degree of coagulation abnormality.

There is currently no standard approach to the management of immature or sick neonates with demonstrable coagulation abnormalities, but many authorities recommend that such infants be treated empirically with fresh frozen plasma (FFP) in the hope of preventing excessive damage from potential intracranial or intrapulmonary bleeding. However, there is no clinical evidence that this approach is reliably effective in reversing abnormal coagulation data in the neonate. In this study 23 infants with immaturity and mild to moderate respiratory distress syndrome received FFP in an attempt to support blood pressure. Prothrombin time (PT), activated partial thromboplastin time (PTT), quantitative platelet count, and levels of fibrinogen were determined before and after infusion to determine the effect of plasma on coagulation status in these infants.

Materials and methods

Babies studied. In our intensive care nursery FFP is sometimes used as a volume expander for attempted control of hypotension. We studied the effects of FFP infusions on the coagulation parameters in infants treated. Altogether 32 infants were studied within the first 48 hours of life. Nine infants were subsequently omitted from the study either because they demonstrated no abnormalities in coagulation studies before FFP infusion or because they had evidence of disseminated intravascular coagulation. All of the 23 patients remaining in the study survived.

Gestational ages ranged from 28 to 38 weeks. Birthweights ranged from 965 to 4450 g. One infant was felt to be large for gestational age; none was judged to be small for gestational age. Twenty of the 23 infants had mild to moderate respiratory distress. PT, PTT, platelet count, and fibrinogen levels were determined in all infants before FFP infusion, and again 15 minutes after completion of plasma infusion. All infants received FFP in a volume of 10 ml/kg.

Laboratory methods. Whole blood, in a volume of 1·8 ml, was obtained by a 2-syringe technique through a 23-gauge scalp vein needle or through an indwelling umbilical artery catheter. Blood was transferred immediately to a tube containing buffered sodium citrate in a ratio of 9 : 1. Plasma was separated at 4°C for 15 minutes at 10 000 rev/min. PT and PTT were done as previously described.[1] The concentration of fibrinogen was determined by microtechnique as described by Searcy *et al.*[2] Platelet counts were done by phase microscopy.

Results

Twenty-three infants with abnormally prolonged PT or PTT were treated with FFP in a dose of 10 ml/kg.