Evaluation of the HemoCue compared with the Coulter STKS for measurement of neonatal haemoglobin

I J Rechner, A Twigg, A F Davies, S Imong

OBJECTIVE: To compare the measurement of haemoglobin concentration (\([\text{Hb}]\)) using the HemoCue haemoglobinometer with that using the Coulter STKS haemoglobinometer.

DESIGN: Thirty two EDTA samples were taken from neonates. \([\text{Hb}]\) was measured in these samples using the HemoCue; the samples were then transferred to the haematology laboratory for \([\text{Hb}]\) determination with the Coulter STKS. In addition, \([\text{Hb}]\) was determined in 50 different random EDTA neonatal samples already held in the laboratory, using the HemoCue and Coulter STKS.

PATIENTS: Neonates in the intensive care and low dependency Units of the Royal Devon and Exeter Hospital.

INTERVENTIONS: Samples were collected from arterial lines or by venepuncture or heel prick into an EDTA bottle.

MAIN OUTCOME MEASURES: \([\text{Hb}]\) using the HemoCue and Coulter STKS methods.

RESULTS: The mean \([\text{Hb}]\) measured using the HemoCue was 150.3 g/l (range 78–215) compared with 152.8 g/l (range 78–217) measured using the Coulter STKS, with a mean of the differences of 2.5 g/l. The standard deviation of the differences of the 82 samples was 3.73 g/l. The limits of agreement of the two methods (mean difference ± 2SD) were −4.8 to +9.8 g/l.

CONCLUSION: With adequate training and monitoring, the HemoCue can be used directly on the neonatal unit for rapid determination of \([\text{Hb}]\) to within 7.5 g/l compared with the laboratory Coulter STKS, using much smaller sample volumes.

METHOD

Principle and operation of the HemoCue

The HemoCue is a device (height 90 mm, width 160 mm, depth 210 mm, weight 250 g) that can be operated using battery or mains electricity. The cuvettes for the HemoCue contain the following dried reactants: sodium desoxylate to haemolysate red blood cells; sodium nitrate to convert haemoglobin into methaemoglobin; sodium azide to convert the methaemoglobin into haemoglobinazide. To prevent decay of these reactants from exposure to the atmosphere, the cuvettes are kept in a sealed container. Whole blood (10 µl) is collected in two cuvettes by capillary action, avoiding the formation of air bubbles. Excess blood is removed from the outside of the cuvette, which must be placed in the cuvette holder of the HemoCue within 10 minutes. Light absorbance is measured at 570 nm and 880 nm to compensate for any turbidity in the sample. \([\text{Hb}]\) is calculated using a programmed algorithm, and the result is displayed usually within 45 seconds. If there is a difference of more than 3 g/l between the two cuvettes, the test should be repeated.
the two methods (mean difference ± 2SD) were −4.8 to +9.8 g/l (fig 1).

DISCUSSION
Neonates in the intensive care unit require frequent [Hb] measurements. The HemoCue is capable of producing a result within minutes. This speed and the small sample volume required have advantages for patient management and also offer potential savings in cost. The small sample volume required also benefits the growing neonate in the low dependency unit, who has weekly [Hb] checks.

We regarded as clinically significant a [Hb] difference of greater than 10 g/l between the HemoCue and the Coulter STKS. This level of clinical significance was used to determine the sample size. In our study, 95% of the values were within 7.5 g/l. On the basis of our level of clinical significance, the HemoCue is therefore an acceptable method of determining [Hb] if used correctly. We found a very wide range of [Hb] values, reflecting the [Hb] of the newborn and that of the long stay or acutely ill neonate found on neonatal units. Our study shows that the HemoCue is accurate over a wide [Hb] range.

Figure 1 Plot of the difference between the results obtained by the two methods against the mean of the results obtained by the two methods of haemoglobin measurement (n = 82). The dashed lines indicate the limits of agreement. [Hb], Haemoglobin concentration.

REFERENCES

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In sickness and in health: the importance of translational regulation. P Reynolds.
The effect of brief neonatal exposure to cows’ milk on atopic symptoms up to age five. M H de Jong, V T M Scharp-van der Linden, R Aalberse, et al.
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Arch Dis Child Fetal Neonatal Ed 2002 86: F188-F189
doi: 10.1136/fn.86.3.F188

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