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Point of Care Measurement of Cord Blood and Fetal Scalp Lactate: Problems of Haematocrit Interference

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BACKGROUND

Measurement of umbilical cord blood and fetal scalp lactate is useful in the assessment of fetal metabolic status for the purpose of informing clinical management and as a tool for defense in medico-legal challenges. Point of Care (POC) meters have the advantage of delivering immediate results on very small whole blood specimens. However, results may be affected by both meter performance and the effect of highly variable haematocrit (Hct)[1] levels.

AIM

To compare lactate measurements, at varying levels of Hct, from a blood gas analyser and two POC meters, with results from a laboratory-based reference standard.

METHODS

Part 1: Laboratory experiment: Venous blood from an adult volunteer was collected into lithium heparin tubes and haematocrit was adjusted to 24%, 40% and 63%. The tubes were placed on a roller for varying hours at room temperature to achieve increasing levels of lactate. All specimens were analysed in three replicates by:

•Laboratory analyser (Beckman Coulter DxC800, Beckman Coulter Brea, CA, USA) - as the reference method

•A blood gas analyser (Radiometer ABL825, Radiometer Medical ApS, Brønshøj, Denmark)

•Two lactate meters:

–Statstrip Express (Nova Biomedical, Waltham, MA, USA) – marketed as able to correct for Hct

–Lactate Pro (Adams Arkray, Shiga, Japan) – manufacturer warns of Hct effect

Part 2: Comparison of cord blood: Fresh mixed arterial and venous umbilical cord blood was measured on the same lactate meters in the Birth Suite (Figure 1). In addition, 500 µL of each cord blood was placed into appropriate collection tubes and taken immediately to the laboratory for the measurement of haematocrit (Abbott Cell-Dyn3700, Abbott Laboratories, IL, USA) and lactate (Beckman Coulter DxC800).

RESULTS

Part 1: Laboratory experiment. Lactate results by Radiometer and Statstrip were similar to that by the reference method regardless of the levels of haematocrit. The Lactate Pro meter, however, gave significantly lower lactate results at a high haematocrit level. Lactate Pro gave a result of 3.6 (Hct 40%) and 2.8 mmol//L (Hct 63%) at a lactate level of 4.7 and 7.3 mmol/L, respectively ($p<0.001$ for both).

Part 2: Real time comparison of cord blood lactate results in the birthing suite.

Figure 3 shows the lactate results from 45 cord blood samples by different methods against the haematocrit levels. Lactate results by both the Beckman Coulter and Statstrip methods appeared to be independent of the haematocrit levels. However, a slight downward trend was observed for the Lactate Pro with increasing levels of Haematocrit.

CONCLUSION

The adult blood laboratory and POC studies confirm the influence of haematocrit level on the lactate result. Clinicians need to be aware of this variability when using lactate results for patient management, especially for the fetus and neonate. The limited findings from the mixed umbilical cord blood warrant further investigation by repeating these comparisons using arterial rather than mixed cord

blood samples. Future studies will compare lactate measurements from umbilical arterial bloods that have high haematocrit levels.