THE PATHCARE NEWS

UMBILICAL CORD BLOOD GAS ANALYSIS

Cord blood gas analysis is considered the gold standard for the determination of intrapartum foetal hypoxia. It provides an objective retrospective method for continuous quality improvement in the management of foetal acid-base abnormalities. It is also sensible to keep normal blood gas results on record for a baby with an uneventful delivery, but who may develop neurological impairment later.

PathCare has created a new report for umbilical cord blood gases. The template reflects arterial and venous analytes on one page, each with the relevant reference intervals.

Table: Reference intervals for arterial and venous umbilical cord blood gas results[1]

Analyte	Arterial Cord Blood	Venous Cord Blood
pH	7.12 - 7.35	7.23 - 7.44
pCO_2 (mmHg)	41.9 - 73.5	28.8 - 53.3
pCO_2 (kPa)	5.6 - 9.8	3.8 - 7.1
pO_2 (mmHg)	6.2 - 27.6	16.4 - 40.0
pO_2 (kPa)	0.8 - 3.7	2.2 - 5.3
Bicarbonate (mmol/L)	19 - 28	17 - 26
Base Excess (BE,ecf)	-9.3 to +1.5	-8.3 to +2.6
Lactate (mmol/L)	2.0 - 6.7	No reference intervals
Foetal umbilical artery pH <7.0 and BE <-12 mmol/L increase the probability of an intrapartum hypoxic event		

Reference intervals:

The reference intervals serve only as a guideline and may vary slightly between the nature of delivery, gestation and maternal co-morbidities, e.g. diabetes mellitus. Cord blood lactate reference values are not as well researched as those for pO_2, pCO_2, bicarbonate, pH and base excess.

Guidelines: who to test?

There is no consensus under which circumstances a cord blood gas analysis should be performed. In South Africa, Bhorat *et al.*[2] have recommended universal assessment of both arterial and venous umbilical cord blood. Sampling both arterial and venous cord blood is the only way to validate that the umbilical artery has been sampled.

Accuracy of umbilical cord blood gas analyses:

As with all laboratory tests, there are false positive and false negative results. Approximately 2% of vigorous babies will have false positive results with umbilical cord blood gases.[2] Cord blood gas results in such cases should be interpreted in the

context of other available standard parameters such as CTG, Apgars and postnatal course. Other factors that may affect the blood gas results include:

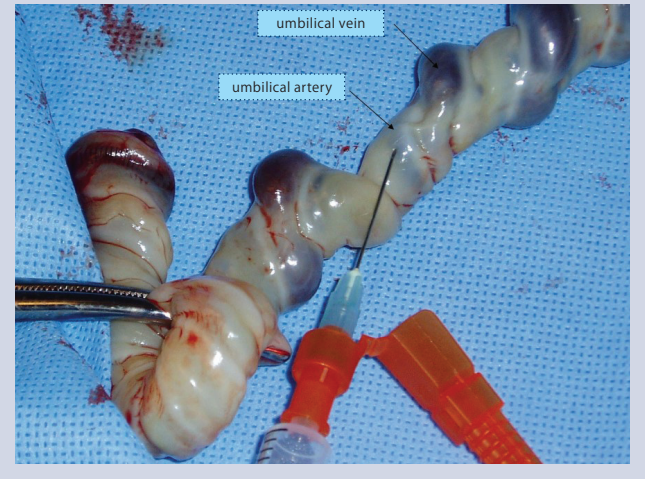
- **Delayed cord clamping:** The American College of Obstetricians and Gynecologists did not find any difference in the pH after delayed cord clamping, although the pO_2 levels increased.[3]
- **Clots:** There is a small risk of the specimen clotting, despite using heparinised syringes. Such samples are unsuitable for analysis.

Sample collection:

- After birth isolate an approximately 20cm segment of cord between two sets of two clamps, and cut between the two clamps at each end. Once the cord segment is isolated from circulation, the acid-base parameters are stable for 60min at room temperature.
- Using two heparinised syringes, sample both the umbilical artery and umbilical vein (see figure below). If only one vessel is sampled it is not readily apparent from the values which it is. Specimens should be analysed within 30min.

Interpretation:

- **How to distinguish arterial from venous cord blood:** pH and pCO_2 are used to distinguish between arterial and venous blood: pH is lower and pCO_2 is higher in arterial than venous cord blood. If the pH difference between the two samples is <0.02 and/or pCO_2 <0.5kPa (<3.7mmHg), the likelihood is that both samples are from the same type of vessel, either arterial or venous.[3]
- **Arterial cord blood gas assessment:** Significant metabolic acidosis is given by arterial pH <7.0 and BE <-12mmol/L.[3]
- **Arterial cord blood lactate assessment:** Lactic acid is primarily responsible for low cord blood pH and BE associated with metabolic acidosis and birth asphyxia. Cord blood values for lactate are less well-described, and published references intervals for arterial cord blood lactate are broad (2.0 - 6.7mmol/L). In a prospective study of 8000 consecutive single deliveries, the optimal cut-offs for the prediction of a lactate acidemia are an **arterial lactate of >3.9mmol/L** (sensitivity of 84% and specificity of 74% for predicting serious neonatal morbidity) and/or a venous lactate of >3.4mmol/L.[4] A local viewpoint suggests that lactate assessment is recommended but not essential.[2]



https://www.mc.vanderbilt.edu/dept/obgyn/High_Risk_Conference/2013/Fetal%20Acid%20Base%20Status%20and%20Umbilical%20Cord%20Sampling-%20D.%20Acker.pdf

References:

1. Higgins C. Umbilical-cord blood gas analysis. Acutecaretesting.org October 2014.
2. Bhorat I et al. The case for the routine use of umbilical cord pH in all deliveries. O&G forum 2017;3: 33-35.
3. Armstrong L et al. Use of umbilical cord blood gas analysis in the assesment of the newborn. Arch Dis Child Fetal Neonatal Ed 2007;92:F430.
4. Tuuli MG et al. Umbilical cord venous lactate for predicting arterial lactic acidemia and neonatal morbidity at term. Obstet Gynecol 2016; 127:674.

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