ACID BASE STATUS AND CEREBRAL OXYGENATION IN NEONATES IMMEDIATELY AFTER BIRTH

Gerhard Pichler^{1,2}, Berndt Urllesberger^{1,2}, Christian Mattersberger^{1,2}, Nariae Baik-Schneditz^{1,2}, Bernhard Schwabegger^{1,2}, Lukas Miledler^{1,2}, Georg Schmölzer^{3,4}

1 Research Unit for Neonatal Micro- and Macrocirculation, Department of Pediatrics and Adolescent Medicine, Medical University of Graz, Austria.
2 Division of Neonatology, Department of Pediatrics and Adolescent Medicine, Medical University of Graz, Graz, Austria.
3 Centre for the Studies of Asphyxia and Resuscitation, Royal Alexandra Hospital, Edmonton, Canada
4 Department of Pediatrics, University of Alberta, Edmonton, Canada

Background and Aim: Cerebral tissue oxygenation in preterm and term neonates is of growing interest. There are no data available concerning influences of acid base status on cerebral tissue oxygenation during immediate transition after birth. Aim of the present study was therefore to investigate possible associations of acid base status and cerebral tissue oxygenation in preterm and term neonates 15 minutes after birth.

Methods: Analyses of secondary outcome parameters of prospective observational studies.

Preterm and term neonates were included, in whom

- 1. cerebral regional tissue oxygenation (crSO₂) was measured during immediate transition after birth and
 - 2. blood samples for blood gas analyses were taken between 15 to 20 minutes after birth
- arterial oxygen saturation (SpO₂) and heart rate were measured by pulse oximeter on the right wrist
 - cerebral fractional-tissue-oxygen-extraction (cFTOE) was calculated out of SpO₂ and crSO₂
 - correlation analyses to investigate potential associations between crSO₂/cFTOE at minute 15 after birth and acid base status (ph-value, base excess (BE), standard bicarbonate (HCO₃)) were performed.

	Preterm n=25	Term n=50	p-Value
Gestational age (weeks)	32.8±3.3	38.7±0.8	<0.001
Birthweight (gram)	1757±545	3149±524	<0.001
APGAR 1	7.7±1.9	8.7±0.9	<0.001
APGAR 5	8.8±1.5	9.7±0.6	<0.001
APGAR 10	9.3±0.9	9.9±0.2	<0.001
Umbilical artery pH value	7.3±0.05	7.3±0.04	0.551
Mean arterial blood pressure (mmHg) *	44±9	46±8	0.218
Central temperature (°C) *	36.8±0.3	37±0.3	0.058
Supplemental oxygen, n (%)	11 (44)	1 (2)	<0.001
Non-invasive respiratory support, n (%)	12 (48)	6 (12)	<0.001
Intubation, n (%)	1 (4)	0 (0)	
Arterial oxygen saturation (%) *	93.9±5.1	96±3.2	0.058
Heart rate (bpm) *	159±15	157.1±19	0.646
Cerebral regional oxygen saturation (%) *	80.2±12.1	83±7.7	0.382
Fractional tissue oxygen extraction *	0.15±0.10	0.14±0.08	0.521
Blood glucose concentration (mmol/L)	2.7±0.9	2.9±0.9	0.079
Blood glucose concentration (mg/dl)	57.5±14.1	53±9.2	0.079
Blood sample p.p. time (min)	17.0±2.0	15.8±1.3	0.008
Lactate concentration (mmol/L)	2.7±0.8	2.8±0.9	0.760
Base excess (mmol/L)	-2.07±2.5	-1.4±2	0.232
Standardized bicarbonate (mmol/L)	21.5±2.6	21.4±1.7	0.699
pH Value	7.29±0.1	7.28±0.1	0.722

Preterm neonates:
(A) Regional cerebral oxygen saturation (crSO₂, %) and pH value; q=0.57, p=0.01
(B) Fractional tissue oxygen extraction (FTOE) and pH value; q=-0.46, p=0.03

Term neonates:
(C) Regional cerebral oxygen saturation (crSO₂, %) and pH value; q=0.03, p=0.82
(D) Fractional tissue oxygen extraction (FTOE) and pH value; q=0.02, p=0.91

Preterm neonates:
(A) Regional cerebral oxygen saturation (crSO₂, %) and base excess (mmol/L); q=0.54, p=0.01
(B) Fractional tissue oxygen extraction (FTOE) and base excess (mmol/L); q=-0.49, p=0.02

Term neonates:
(C) Regional cerebral oxygen saturation (crSO₂, %) and base excess (mmol/L); q=-0.03, p=0.82
(D) Fractional tissue oxygen extraction (FTOE) and base excess (mmol/L); q=0.11, p=0.45

Preterm neonates:
(A) Regional cerebral oxygen saturation (crSO₂, %) and standardised bicarbonate (mmol/L); q=0.27, p=0.21
(B) Fractional tissue oxygen extraction (FTOE) and standardised bicarbonate (mmol/L); q=-0.15, p=0.48

Term neonates:
(C) Regional cerebral oxygen saturation (crSO₂, %) and standardised bicarbonate (mmol/L); q=0.015, p=0.92
(D) Fractional tissue oxygen extraction (FTOE) and standardised bicarbonate (mmol/L); q=0.03, p=0.85

Conclusion:
In preterm neonates immediately after birth there are associations of cerebral oxygenation and acid base status parameters, whereas in term neonates these associations cannot be observed.