September 18th, 2021 08:30 - 10:30

PARALLEL SESSION 35 - UENPS 3

ID 52. Impact of carbon dioxide on cerebral oxygenation and vital parameters in stable preterm and term neonates immediately after birth

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Background
Carbon dioxide (pCO2) is one of the most potent mediators influencing cerebral auto-regulation and cerebral blood flow due to changes in the tone of cerebral vessels. The aim of the present study was to evaluate a potential correlation between pCO2 and cerebral oxygen saturation (crSO2), cerebral fractional tissue oxygen extraction (cFTOE) and cerebral tissue oxygen extraction (cTOE) measured with near-infrared spectroscopy (NIRS), and routine monitoring parameters [heart rate (HR), arterial oxygen saturation (SpO2), mean arterial blood pressure (MABP) and rectal body temperature] 15 minutes after birth in preterm and term neonates with no need for medical support.

Methods
Secondary outcome parameters of prospective observational studies conducted between 2009 and 2018 at the Division of Neonatology Graz, were analysed. Included were preterm and term neonates with NIRS monitoring during the first 15 minutes after birth and a blood gas analysis performed at discretion of the attending neonatologist between 14-18 minutes after birth. Excluded were neonates with respiratory and medical support. The NIRS measurements were performed with an INVOS monitor. cFTOE was calculated out of SpO2 and crSO2: cFTOE=(SpO2-crSO2)/SpO2. The correlation between pCO2 and NIRS parameters and clinical routine monitoring parameters in minute 15 after birth were calculated in preterm and term neonates.

Results
Eleven preterm neonates with a median(IQR) gestational age of 34.8 (32.7;36.1)weeks were analysed. Median pCO2 was 54.6 (49.0;57.9) mmHg. In minute 15 after birth crSO2 was 82.6 (74.3;91.3)%, cFTOE 0.13 (0.06;0.24), HR 152 (136; 167)bpm and SpO2 97.4 (95.2;99.6)%. pCO2 correlated significantly negatively with crSO2 and positively with cFTOE and cTOE (Figure 1 a-d). Further, pCO2 showed a trend towards positive correlation with HR and MABP and towards negative correlation with SpO2.
84 term neonates with a median gestational age of 39.0 (38.5;38.9)weeks were analysed. Median pCO2 was 53,5 (51,7;55,2)mmHg. In minute 15 after birth crSO2 was 84.4 (80.8;85.1)%, cFTOE 0,13 (0,12;0,16), HR 155 (153;163)bpm and SpO2 96,9 (95,8;97,2)%. pCO2 did not correlate with any parameter.

Conclusion
In preterm neonates higher pCO2 values were associated with lower crSO2 and higher cFTOE and cTOE values, whereas no association between pCO2 and cerebral tissue oxygenation was observed in term neonates.

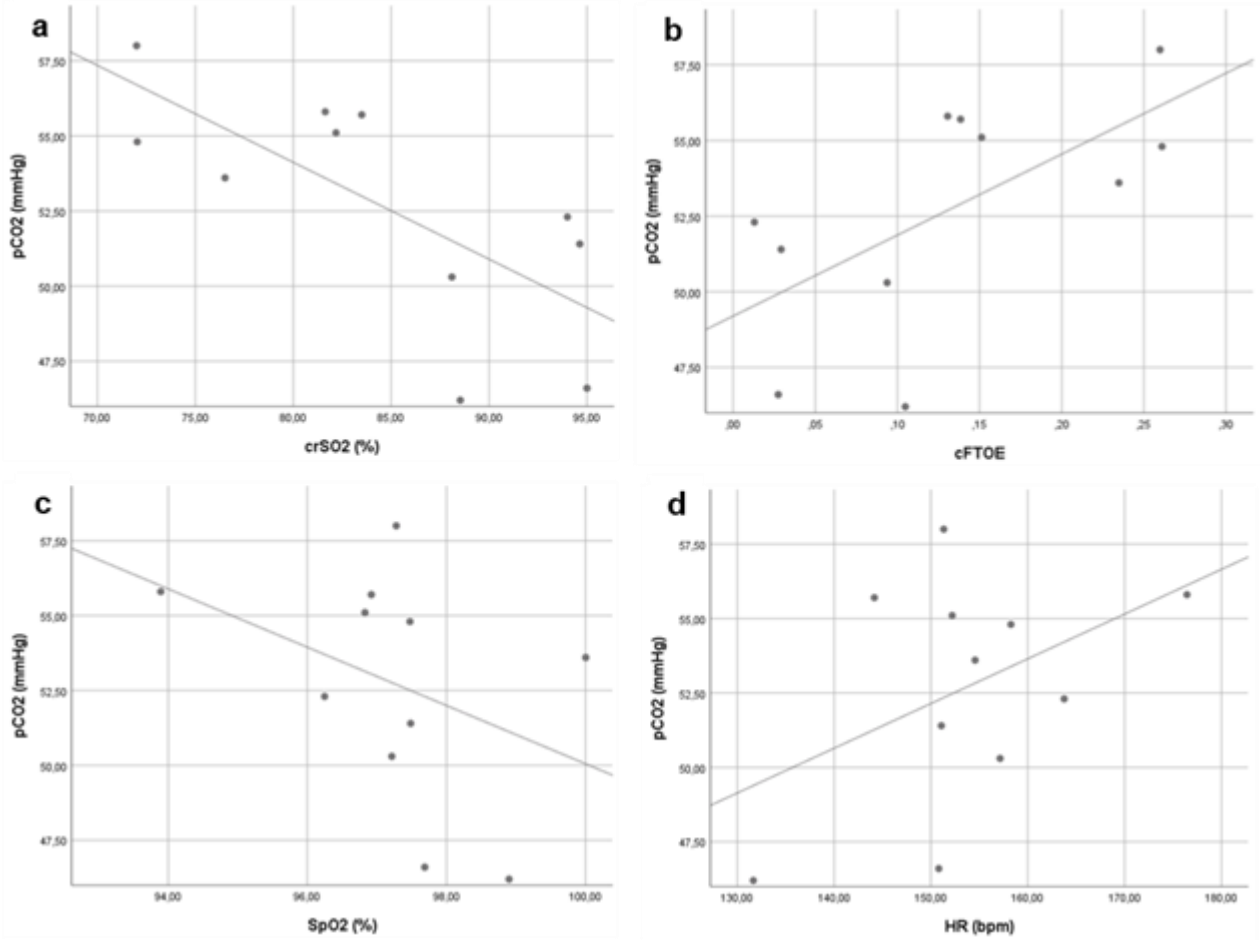

Figure 1 (a-d). Correlations of blood gas pCO2 and NIRS monitoring parameter (crSO2 and cFTOE) and routine parameters (SpO2 and HR) in 11 preterm neonates

None declared.

ID 69. Increased risk for cerebral hypoxia during immediate transition in healthy term neonates with prenatal tobacco exposure

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Background
Maternal tobacco smoking during pregnancy is a global issue and still prevalent. The impact of smoking on pregnancy related conditions and fetal and neonatal morbidities and mortalities are reported.
The aim of the present study was to evaluate if healthy term neonates of mothers who had smoked during pregnancy differ in cerebral oxygen saturation (crSO2) and cerebral fractional tissue oxygen extraction (cFTOE) measured with near-infrared spectroscopy (NIRS) during immediate postnatal transition from neonates of mothers who had not smoked during pregnancy.

Methods
Secondary outcome parameters of prospective observational NIRS studies conducted at the Division of Neonatology Graz were analyzed. Included were term neonates without medical support within the first 15 minutes after birth, when maternal information on their smoking behaviour during pregnancy were obtained. The NIRS measurements were performed with the INVOS 5100C monitor. Term neonates with prenatal tobacco exposure were stratified to the smoking group and those without prenatal tobacco exposure were stratified to the non-smoking group. The term neonates in the smoking group were matched according to gestational age (± 1 week), birth weight (± 100 grams) and haematocrit value (± 5 %) to term neonates in the non-smoking group.

Results
24 term neonates without medical support were included in the present analysis. 12 neonates were analyzed in smoking group with a median gestational age of 39.1 (38.8-39.3)weeks and birth weight of 3155 (2970-3472)g; and 12 neonates were analyzed in the non-smoking group with a gestational age of 39.1 (38.7-39.2)weeks and birth weight of 3134 (2963-3465)g. crSO2 was significantly lower in the smoking group within the first five minutes after birth, whereby cFTOE was significantly higher in the smoking group. HR was also significantly higher in the smoking group in minute three after birth, compared to the non-smoking group. Afterwards, there were no significant differences in crSO2, cFTOE, SpO2 and HR between the two groups.

Conclusion
To conclude, in healthy term neonates with prenatal tobacco exposure lower crSO2 and higher cFTOE were observed compared to neonates without within the first five minutes after birth. Risk for cerebral hypoxia is increased due maternal smoking during pregnancy.
None declared

ID 501. Delivery-associated intrauterine cord obstruction and delayed cord clamping affects blood gas values but not NEC sensitivity in preterm pigs

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Background

Hypoxia and ischemia from cord obstruction during delivery may negatively affect lung, brain and gut functions in preterm infants. Moreover, optimal cord clamping procedures may support postnatal adaptation. At cesarean section, it remains unclear if delayed cord clamping improves fetal-to-neonatal transition, relative to immediate clamping and umbilical cord milking. Using caesarean-delivered preterm pigs as models, we hypothesized that 1) preterm birth negatively affects adaptation to delivery-associated intrauterine cord and 2) delayed cord clamping improves vital signs and adaptation in preterm pigs, including later sensitivity to necrotizing enterocolitis (NEC).

Methods

Experiment 1: Piglets delivered by caesarean section at preterm (90% gestation, n=41) or near-term (98% gestation, n=51) were subjected to intrauterine cord obstruction (5-7 min), or immediate delivery with umbilical cord milking before cord transection. Experiment 2: Cesarean-delivered preterm piglets (90% gestation) were subjected to umbilical cord milking (n=30) or delayed cord clamping (1 min, n=34) before cord transection. Vital signs and blood gases were followed for 4 days of formula-feeding, predisposing to gut NEC lesions.

Results

Experiment 1: Intrauterine cord obstruction induced a mixed respiratory-metabolic acidosis in both preterm and near-term pigs just after birth (Table 1), which for surviving pigs normalized within few hours of life. The obstruction was less tolerated by preterm pigs, resulting in difficult resuscitation and higher mortality, relative to near-term pigs (88% mortality versus 13% mortality within 1h). Experiment 2: Preterm pigs benefited from delayed cord clamping, as indicated by higher blood pH and lower pCO2 in the first 24hrs. (no differences in saturation, heart rate, blood pressure, hematology). NEC incidence on day 4 was not affected by intrauterine cord obstruction in near-term pigs, nor by delayed cord clamping in preterm piglets.

Conclusion

Delivery-associated hypoxia/ischemia is less tolerated by preterm than near-term pigs. Following cesarean delivery, delayed cord clamping induced a moderate improvement in neonatal physiological adaptation in preterm pigs relative to cord milking. Immediate postnatal NEC sensitivity was not affected by birth hypoxia or cord clamping procedures, but longer-term effects on organ maturation remain to be determined. In perspective, preterm pigs is a relevant model to study the effects of delivery-associated complications on later morbidities.

		pH		pCO_2 (mmHg)		Lactate (mmol/L)			
		Birth	4 hrs.	Birth	4 hrs.	Birth	4 hrs.	NEC (%)	Mortality (1 h)
Experiment 1	DICO (n=24)	7.12 ±0.08*	7.45 ±0.04	99.7 ±14.3*	46.2 ±3.7	5.3 ±1.4*	2.9 ±0.9	-	88%
	Pre-term Controls (n=17)	7.30 ±0.01	7.48±0.06	72.7 ±11.0	43.3 ±6.0	3.4 ±0.9	2.3 ±0.9	-	47%
	DICO (n=29)	7.16 ±0.09*	7.39 ±0.12	94.2 ±15.1*	49.2 ±7.3	5.2 ±1.6*	2.8 ±2.7	32%	13%
	Near-term Controls (n=22)	7.32 ±0.03	7.38 ±0.09	68.8 ±3.5	49.7 ±8.0	2.5 ±0.3	3.4 ±1.8	33%	9%
		Baseline		Baseline		Baseline		NEC (%)	Mortality (1 h)
Experiment 2	Pre-term DCC (n=34)	7.28 ±0.09*	7.37 ±0.09*	67.3 ±11.3*	58.7 ±10.9*	3.3 ±1.0	2.1 ±1.0	46%	3%
	Pre-term UCM (n=30)	7.20 ±0.08	7.25 ±0.15	74.2 ±10.8	74.1 ±17.7	4.5 ±1.4	2.2 ±1.0	57%	0%

All data presented as means with ± standard deviations. Birth, time of delivery; Baseline, 2 hours after delivery; 4 hrs., 4 hours after delivery; DICO, delivery-associated intrauterine cord obstruction; DCC, delayed cord clamping; UCM, umbilical cord milking; NEC, necrotizing enterocolitis; n, numbers; *, p less the 0.05 compared to control in experiment 1, or UCM in experiment 2 at same time point; -, not recorded.

Table 1. Differences in blood gases, NEC and neonatal mortality in Experiments 1 and 2

none declared

ID 502. A randomised controlled study of low-dose, high-frequency simulation training for competence in neonatal resuscitation

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BACKGROUND
Simulation training shows potential to increase competence in time-critical interventions such as positive pressure ventilation (PPV) of non-breathing newborns. The unpredicatable need for neonatal resuscitation means many different healthcare personnel (HCP), potentially with very little real-life experience, may be required to initiate PPV until competent help arrives.
METHOD
A novel, high-fidelity newborn simulator, facilitating low-dose, high frequency training (LDHFT) in PPV and giving immediate performance feedback, was used in a randomised controlled study of the effect of simulation training in 6 different groups of HCPs commonly present at neonatal resuscitations.
187 HCPs were recruited and baseline competence was assessed in 2 simulations of differing difficulty (test 1). After a 3 hour personalised education session, participants were tested again with the same 2 scenarios (test 2) and randomised to train twice a month, or as desired, over a 9-month period. Test 3 repeated the same 2 scenarios after 9 months of own-training.
Each test was observed by the same investigator and scored according to demonstation of knowlege (to a maximum of 10 points) and ventilation performance assessed objectively by the simulator (to a maximum of 30 points) giving a total of 40 points for each scenario.
RESULTS
Mean score of both scenarios at test 1 was 31.2. Paediatricians scored significantly higher than all other groups except anaesthetists. Following the educational session, the mean score rose to 37.9 with no significant difference between HCP groups. 104 HCPs randomised to train as desired performed an average of 2.8 own-trainings, while 83 HCPs randomised to train twice a month performed an average of 8 trainings. Average score at test 3 was 36.3 with no significant difference according to randomisation or between HCP groups. Subgroup analysis comparing no training to 9 or more trainings shows a significant difference at test 3 in favour of LDHFT.
CONCLUSION
Study participation resulted in equivalent, high-scoring perfomance in all HCPs at tests 2 and 3. No difference at T3 according to randomisation may reflect protocol violation. Subgroup analysis shows clear benefit to LDHFT for some HCPs, including anaesthesia nurses and paediatric nursing assistants. PPV competence can be trained.

Study particpant perfoming PPV with neonatal heartrate displayed both on a monitor applied to the manikin and via the simulator App on a tablet device.

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