ID: 276
TITLE: SHIFT OF THE SPO2/PIO2 CURVE ASSESSED EARLY IN LIFE ENABLES PREDICTION OF BRONCHOPULMONARY DYSPLASIA IN EXTREMELY PRETERM INFANTS
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CONTENT:

Rightward shift of the peripheral arterial oxygen saturation (SpO2)/ and inspired oxygen pressure (PIO2) curve is a sensitive marker of pulmonary gas exchange in preterm infants. We hypothesised that rightward shift of the SpO2/PIO2 curve in the first weeks of life is a predictor of bronchopulmonary dysplasia (BPD) at 36 weeks (w) postmenstrual age (PMA).

This was a prospective observational study. Infants born at < 28 w gestation at the King Edward Memorial Hospital in Western Australia between 21st August 2017 – 1st April 2018 were eligible for inclusion. Rightward shift was assessed weekly from birth until 36 w PMA by recording SpO2 and PIO2 at hourly intervals for 24 h. Right shift was calculated from the paired SpO2/PIO2 values using a validated prediction table.

32 extremely preterm infants with a median (range) gestational age of 26.4 (23.9–28.0) w were studied. Infants with BPD were born at a lower gestation: Median (IQR) gestation was 25.7 (25.1–26.6) w for the BPD group compared to 27.3 (26.6–27.4) w for infants without BPD (p<0.001). Shift values in infants with BPD were significantly higher compared to infants without BPD throughout week one to eight of life (all p <=0.001, Mann-Whitney U tests). Receiver operating characteristic curve analysis showed a shift value of 11.4 kPa at one week of age predicts BPD with 89.5% sensitivity and 91.7% specificity (AUC:0.91, p<0.001). A shift value of 16.1 kPa at one week of life predicts moderate and severe BPD at 36w PMA with 77.8% sensitivity and 86.4% specificity (AUC:0.84, p=0.004). Shift at two weeks of life was significantly correlated with shift at 36w PMA (R² = 0.71, p<0.001).

Shift assessed at one week of age enables prediction of BPD at 36 weeks PMA. Prediction of moderate and severe BPD should be treated with caution for the limited number of infants included in the study. Nevertheless, infants with high shift values at two weeks of age are at risk of moderate to severe BPD. Early detection of preterm infants at risk for the development of BPD might benefit from targeted early interventions.

COI: None declared.
ID: 419
TITLE: CLINICAL OUTCOMES OF AUTOMATED OXYGEN CONTROL IN PRETERM INFANTS: A RETROSPECTIVE COHORT STUDY
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CONTENT:

Adhering to the therapeutic range for supplemental oxygen in preterm infants is a difficult but important task to prevent damage associated with hypoxaemia and hyperoxaemia. Several trials demonstrated that time spent within target range increases when automated oxygen control (AOC) is used, however none of these trials assessed clinically relevant outcomes. In mid-2015 AOC was implemented as standard of care in the NICU of Leiden University Medical Center. This study aimed to compare clinical outcomes of preterm infants born before and after implementation of AOC.

Using a retrospective cohort design, preterm infants born under 30 weeks of gestation were compared using two cohorts: after implementation of AOC as standard of care in mid-2015 (August 2015 – December 2018) and prior to implementation (May 2012 – August 2015). Patient demographics (gestational age, sex etc.), mortality, occurrence and treatment of retinopathy of prematurity (using ETROP criteria), bronchopulmonary dysplasia (BPD), necrotising enterocolitis (NEC), intraventricular haemorrhage (IVH), periventricular leukomalacia (PVL), duration of NICU stay and number of ventilation days were scored for all preterm infants. Effect estimates were adjusted for confounders.

In total, 612 preterm infants were included (306 pre- cohort vs 306 in the post-implementation cohort) with a median (IQR) gestational age of 28±1 (26+4 – 29). There were no statistically significant differences between cohorts regarding gestational age, sex, parity, antenatal corticosteroid administration, birth weight, 5-minute Apgar score and mode of delivery. The proportion of preterm infants that died within 1 month of corrected term age or developed ROP, BPD, NEC, IVH or PVL did not differ between cohorts (pre: 163/306 vs post: 160/306, p=NS; table 1). Duration of stay on the NICU was slightly higher in the post-implementation group (pre: 32.9 SD 26.1 vs post: 35.4 SD 27) but not significantly different. A decrease in ventilation days from 6.4 ± 10.1 in the pre- group to 4.7 ± 8.3 days in the post-implementation group was not statistically significant after multivariate analysis.

Implementation of AOC did not lead to a decrease or increase in short term morbidity or mortality in very preterm infants.

IMAGES:
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Table 1: Clinical outcomes. ETROP type 1 = indication for laser therapy, type 2 = indication for watchful waiting. *After adjusting using multivariate analysis

COI: None declared
ID: 657

TITLE: PERINATAL HYPOXIC PRECONDITIONING INDUCES SURFACTANT SYNTHESIS AND PREVENTS LUNG DAMAGE AFTER AN HYPOXIC INSULT IN A MICE MODEL OF THE FNT

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CONTENT:

PaO2 increases significantly with the initiation of air breathing immediately after birth causing physiological OS. Preterm newborns have immature antioxidant defenses and often need oxygen supplementation to achieve postnatal stabilization. The use of 100% O2 for resuscitation increases OS and specific morbidities. Hyperoxia causes structural and functional alterations of surfactant and reduces pneumocytes II ability to synthesize it while it causes OS in lung tissue. We hypothesize that hypoxic preconditioning during fetal-to-neonatal transition would preserve existing lung surfactant, pneumocytes II ability to synthesize surfactant and attenuate OS in lung submitted to hyperoxic insult.

Pregnant mice randomly delivered in an FiO2=0.14 (HYP) or 0.21 (NORM) and their offspring were kept for 8H in the assigned FiO2. FiO2 was increased then to 1.0 for 1H and thereafter switched to 0.21 in both groups. Offspring were sacrificed at P1 or P7. Controls were kept all the time in 0.21. We analyzed transsulfuration pathway metabolites, biomarkers of OS damage to proteins and to lipid components using validated HPLC-MS/MS approach. In addition, we determined peroxides and analyzed different signaling pathways such as synthesis surfactant pulmonary or HIF1a targets by qPCR and WB. Lung morphology was studied using violet cresyl and apoptosis with caspase-3 immunostaining. Finally, using EM we focused on pulmonary surfactant and structural disorganization of lung cell membranes.

In the HYP group, reducing metabolites such as GSH, cystathionine and Cys were significantly increased as compared to the NORM group due to increased transsulfuration pathway metabolic activity secondary to overexpression of CBS. Moreover, the NORM group exhibited increased levels of biomarkers of oxidative damage to proteins, lipid peroxidation and peroxides as compared to the HYP. WB of SP-B, and pSTAT3 were reduced in the NORM group. Analysis of the pSTAT3 revealed high levels of IL-6 gene expression in the HYP group and decreased levels of sosc3 and HSP2 in the HYP group as compared to NORM and control groups at. Lung histology revealed increased caspase-3 positive cells in club cells in the NORM group. Finally, EM at P1 and P7 in type II pneumocytes showed in the NORM group a clear reduction of surfactant content compared with the control group while being preserved in the HYP group

Keeping mice offspring in a hypoxic atmosphere after birth favors the maintenance of a lung cell reducing environment that confers protection from a hyperoxic insult. Hence, the ability to store and synthesize surfactant is preserved and levels of biomarkers of oxidative stress are reduced. These results underscore the relevance of a strict control of oxygen supplementation in preterm infants after birth and may have translational applicability.

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COI: None declared
ID: 925

TITLE: THE EFFECT OF INITIAL HIGH VERSUS LOW FIO2 ON BREATHING EFFORT IN PRETERM INFANTS AT BIRTH: A RANDOMIZED CONTROLLED TRIAL

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CONTENT:

Non-invasive ventilation in preterm infants at birth is hampered by closure of the glottis between breaths when breathing is intermittent. Infants are currently stabilized with initial low FiO2 (0.21-0.3) which increases the risk of hypoxia and suppression of breathing in the first minutes after birth. We hypothesized that stabilization of preterm infants at birth with an initial high FiO2 (1.0), followed by titration, would improve breathing effort when compared to an initial low FiO2.

In a bi-centre randomized controlled trial, infants < 30 weeks GA were stabilized at birth with an initial FiO2 of 0.3 or 1.0, after which oxygen was titrated using the reference ranges described by Dawson et al.(2010). Primary outcome was minute volume of spontaneous breathing. We also assessed tidal volumes, mean inspiratory flow rate (MIFR) and respiratory rate with a respiratory function monitor. Pulse oximetry was used to measure heart rate and SpO2 values. Hypoxia was defined as SpO2 95%. Differences in breathing effort and oxygenation parameters were tested with a Student’s t-test or Mann-Whitney u-test, depending on the distribution. The interaction of breathing effort parameters with time was analysed with a linear mixed model.

52 infants were randomized (26 in 100% O2-group, 26 in 30% O2-group) and recordings were obtained in 44 infants (20 infants in 100% O2-group, 24 infants in 30% O2-group). Minute volumes (mL/kg) were significantly higher in the 100% O2-group (146.34 ± 112.68 mL/kg/min) compared to 30% O2-group (74.43 ± 52.19 mL/kg/min), p=0.014. Average tidal volumes and MIFR in the first 5 minutes after birth were significantly higher in the 100% group, while the duration of mask ventilation given was significantly shorter (Table 1). Oxygenation was significantly higher in infants in the 100% O2-group (85 (64 – 93)% compared to 30% O2-group (58 (46 – 67)%)(p<0.001) in the first 5 minutes after birth. The duration of hypoxia was significantly shorter in the 100% O2-group, while the duration of hyperoxia was not different between groups (Table 1).

Initiating stabilization of preterm infants at birth with 100% oxygen led to a higher breathing effort, improved oxygenation, and a shorter duration of mask ventilation as compared to 30% oxygen, without increasing the risk for hyperoxia.

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Table 1 Results of breathing effort and oxygenation

COI: None declared.