ID: 567

TITLE: A CLINICAL APPROACH ON DETECTING GAS EXCHANGE MECHANISMS UNDER HFOV IN PRETERM INFANTS

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CONTENT:

Despite the routine use of antenatal steroids, exogenous surfactant and differentiated non-invasive ventilation methods, some preterm and term infants still require invasive ventilation. In turn, mechanical ventilation can induce ventilator induced lung injury leading to lifelong pulmonary sequelae. High-frequency oscillatory Ventilation (HFOV) with tidal volumes below dead space and high frequency is widely used either as primary or rescue therapy in severe neonatal respiratory failure and may be lung-protective. Nevertheless, the underlying gas exchange mechanisms during HFOV are not fully understood to date.

In this study, gas transport and exchange mechanisms along the airway tree of a preterm infant have been investigated using a highly resolved patient specific computational lung model. Lung modelling was based on in-vivo data, derived from Magnetic Resonance Imaging (MRI) and Infant Lung Function Testing (ILFT) from a child with BPD. In order to compare the suitability of different respirator settings, gas flow and oxygen delivery have been computed for two high frequency (HF) ventilation settings and one conventional frequency (CF) setting.

In this in-silico BPD-lung model, both HF-settings deliver more oxygen to the lung tissue at lower pressures amplitudes compared to conventional ventilation (5.31 ml O2/s in HF-setting two vs. 3.63 ml O2/s in the CF-setting). Further, the regional lung tissue aeration is more homogeneous for the HFOV settings reducing the risk for overdistension in regions with low regional compliance.

HFOV is superior in terms of oxygen supply, homogeneity of lung tissue aeration and pressure reduction compared to a conventional ventilation strategy. The awareness of gas transport phenomena during HFOV in preterm infants advances general knowledge on protective ventilation strategies in neonatal care and can support decisions on various modes of ventilatory therapy at high frequencies.

COI: None declared
ID: 688

TITLE: LAMELLAR BODY COUNTS ON GASTRIC ASPIRATE AND RESPIRATORY MECHANICS BY THE FORCED OSCILLATION TECHNIQUE FOR PREDICTING SURFACTANT NEED IN PRETERM INFANTS

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CONTENT:

Lamellar Body Counts (LBC) on gastric aspirate (GA) has been suggested as a possible method for the early identification of preterm infants requiring pulmonary surfactant (Verder 2013). Early assessment of respiratory system mechanical properties by the Forced Oscillation Technique (FOT) may also provide useful information for guiding surfactant therapy (Veneroni 2019).

Study Objective: to evaluate the role of LBC on GA and non-invasive lung mechanics assessed by FOT after birth in non-intubated preterm infants for an early prediction of surfactant need.

Inclusion criteria: preterm infants between 28+0 and 34+6 weeks of gestation. Exclusion criteria: intubation for cardiopulmonary resuscitation, major congenital malformations, perinatal asphyxia. The LBC on GA was determined at birth as described in da Silva Daniel (2010). Respiratory system reactance (Xrs) was assessed by FOT within 2h of life: a small amplitude oscillatory pressure at 10 Hz was superimposed on CPAP at 5cmH2O by a modified ventilator (FabianHFO, Acutronic) and a face-mask, held in place by the attending physician. Xrs was calculated off-line from flow and pressure tracing over five artefact-free breaths. FiO2 was titrated to target 89-94% and surfactant was given as in Sweet (2016).

Among the 53 infants enrolled to date, both LBC and Xrs were significantly lower in patients receiving surfactant (SURF, n=15) than those not receiving surfactant (no-SURF, n=38): LBC (median [IQR]) 18.0 [6.7;55.9] vs 81.0 [36.0 ;138.0] *103/µL; Xrs (median [IQR]) -25.6 [-41.3;-15.0] vs -52.0 [-57.7; -36.3] cmH2O*s/l (Mann-Whitney Rank Sum Test, p <0.05).

Due to the high variability of the no-SURF, we divided it into two subgroups: spontaneously breathing patients not requiring respiratory support (SB) and patients requiring nasal CPAP but not surfactant (CPAP). Figure 1 represents Xrs (A) and LBC (B) (median[IQR]) among the 3 groups: Xrs was significantly lower in SURF than in SB and CPAP (Kruskal-Wallis 1-way ANOVA, p < 0.05), whereas LBC did not show significant differences among the 3 groups (p > 0.05).

Both LBC on GA and early assessment of lung mechanics by FOT were feasible and suitable for the clinical setting. Preliminary data suggest FOT showed a better predicting value than LBC for targeting surfactant therapy. This might be related to FOT’s capability of measuring the overall mechanical properties of the lung rather than considering a single sampling of GA.

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COI: none declared
TITLE: FIVE-YEAR SINGLE CENTER EXPERIENCE ON SURFACTANT TREATMENT IN PRETERM INFANTS WITH RESPIRATORY DISTRESS SYNDROME: LISA VS INSURE

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CONTENT:

Surfactant administration traditionally involved endotracheal intubation and mechanical ventilation, which is associated with a risk of barotrauma and volutrauma. To compare the morbidity and mortality rates between LISA-treated and INSURE-treated premature babies with respiratory distress syndrome (RDS).

We assessed retrospectively the medical records of preterm infants who were born at 250/7 to 296/7 weeks of gestation and were administered surfactant initially either with LISA or INSURE method over a five-year period. Between those infants, the ones who suffered from RDS and received surfactant (200 mg/kg poractant alfa) via INSURE or LISA method were included to the analysis. Infants with major congenital anomalies or incomplete medical records as well as infants who required intubation in the delivery room or received distinctive types or doses of surfactant were excluded from the study.

Analysis of the data of 205 LISA-treated and 178 INSURE-treated infants revealed the mean gestational age as 28.1±1.3 and 28±1.3 weeks and mean birth weight as 1041±205 and 1029±222 g in LISA and INSURE groups, respectively. The mechanical ventilation requirement in the first 72 hours of life (%26.8 – %42.1, p=0.002) and the incidence of moderate-severe BPD (%12.2 – %21.9, p=0.01) were lower in LISA-treated infants. LISA method was found as an independent factor in reducing mechanical ventilation requirement in the first 72 hours of life and incidence of moderate-severe BPD [RR: -0.49 (%95 CI - 0.28 to -0.85), p=0.01] (Table).

Data obtained from our five-year clinical experience are comparable with the recent literature. LISA is currently the most suitable method of surfactant administration and it should be the first choice in spontaneously breathing infants considering its favorable effects on respiratory morbidities in preterm infants with RDS.

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The Rates of BPD and MV Requirements among the groups

COI: None declared.
ID: 759  
**TITLE:** PULMONARY OUTCOME OF VLBW FOLLOWING PPROM – OBSERVATIONAL DATA OF COMBINED SURFACANT-BUDESONIDE TREATMENT AND THE GNN  
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**CONTENT:**

Topical lung-steroid treatment e.g. by surfactant/budesonide has become a therapeutic option for prevention of bronchopulmonary dysplasia (BPD). Infants with history of preterm premature rupture of the membranes (PPROM) are at high risk for BPD due to additional prenatal risk factors like anhydramnios, ascending materno-fetal infections, respiratory distress and need for increased respiratory support. Since 2008, the German neonatal network (GNN) is prospectively collecting clinical data of ~15,000 very low birth weight infants (<36 weeks of gestation and <1500g birth weight).

In the GNN database, the groups with and without PPROM >5 days were compared. The clinical characteristics, ventilation support (duration of invasive and total ventilation), pneumothorax, duration of hospital stay and outcome parameters with respect to BPD at 36 weeks of gestational age (GA) and IVH were described (mean, SD or %) and statistically analyzed by Chi-square test. Subsequently in the subgroup developing BPD or death, a logistic regression analysis was conducted determining the effect of PPROM, GA or antenatal steroids. Retrospectively, the clinical course of all premature infants born in the period 2016-2018 with PPROM at two level 1 neonatal intensive care units, treated on day one of life due to clinical severe respiratory distress with surfactant/budesonide was summarized.

In Table 1 clinical characteristics of the surfactant/budesonide cohort with PPROM > 3 days (n=20) is shown in comparison to the GNN groups with and without PPROM >5 d. Ventilation strategies included continuous positive airway pressure (CPAP), high flow nasal cannula, conventional mechanical ventilation, high frequency oscillation (HFO), CPAP-HFO and nasal intermittet positive pressure ventilation (nIPPV). All analyzed parameters in GNN gave significant differences. Logistic regression analysis gave a risk reduction for development of BPD/death of 0.61 (95% CI: 0.59-0.63) for each completed gestational week, whereas PPROM increased the risk by 1.6 (95% CI: 1.3-2.1) and antenatal steroids showed no effects. The surfactant/budesonide cohort consisted of smaller, more premature infants with longer duration of PPROM and more invasive ventilation support.

Premature birth following PPROM >5 days increases risk for mortality and long term respiratory morbidity. New treatment strategies like early surfactant/budesonide, CPAP-HFO- or nIPPV-ventilation are in use. Surfactant/budesonide was used in premature infants with high morbidity. It is unclear whether this treatment strategy improves outcome. Thus, efforts for randomized controlled clinical trials are needed.

**IMAGES:**  
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On the left side clinical characteristics of the cohort treated with surfactant/budesonide is displayed. On the right side the german neonatal network (GNN) groups with preterm premature rupture of the membranes (PPROM) longer than 5 days (GNN+PPROM>5d) or without this property (GNN w/o PPROM>5d). Either mean (M), SD and the number or the ratio (%) are shown. The GNN data were statistically compared using the Chi-square test. *: p<0.05.
GA: gestational age, HFO: high frequency oscillation; Ventilation= invasive and non-invasive ventilation; IVH: intraventricular haemorrhage

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