September 15th, 2021 15:00 - 17:00

PARALLEL SESSION 7 - LUNG 2

ID 185. AIR DISTRIBUTION DURING NON-INVASIVE HIGH-FREQUENCY VENTILATION IN PRETERM INFANTS

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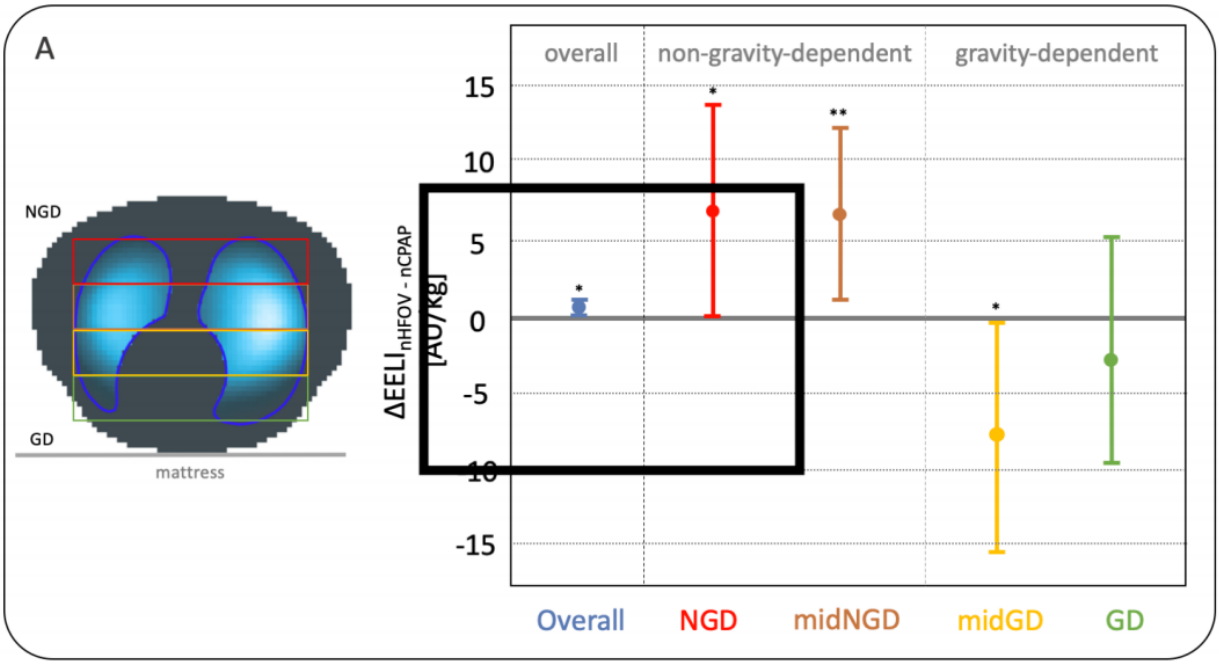
Introduction:
The use of non-invasive high-frequency oscillatory ventilation (nHFOV) in preterm infants may be beneficial in selected clinical situations. However, the underlying pathophysiological mechanisms are still unexplained.

Objectives:
To compare distribution of ventilation and aeration between nHFOV and nasal continuous positive airway pressure (nCPAP).

Methods:
During a recent randomized crossover trial comparing nHFOV with nCPAP, electrical impedance tomography (EIT) data were recorded from 30 preterm infants in prone position. Thirty consecutive breaths were extracted for four recordings per mode of ventilation. During nHFOV, mean airway pressure equaled nCPAP pressure and the smallest amplitude to achieve visible chest wall vibration was used. Ventilation distribution of spontaneous breaths was assessed in 32 horizontal slices. Differences in end-expiratory lung impedance (EELI) between nHFOV and nCPAP were calculated for the whole lung and for four horizontal regions of interest.

Main Results:
Overall, 228 recordings were analyzed. Ventilation distribution of spontaneous breaths was similar between nHFOV and nCPAP. Considering the entire EIT signal including oscillatory volumes, aeration of the lung was increased during nHFOV compared to nCPAP [Mean difference (95% CI) = 0.4 (0.2 – 0.6) AU/kg, p=0.013]. This effect was mainly due to an increase in EELI in the non-gravity-dependent regions of the lung [ΔEELINGD = 6.9 (0.0 – 13.8) AU/kg, p=0.028; ΔEELImidNGD = 6.8 (1.2 – 12.4) AU/kg, p=0.009], see Figure 1.

Conclusion:
Distribution of spontaneous breathing is similar during nHFOV and nCPAP but overall aeration is higher during nHFOV, particularly in the non-gravity-dependent regions of the lung. This may indicate that spontaneous breathing is not affected by nHFOV but that the superimposed oscillations contribute to potential clinical benefits.



Changes in aeration between nHFOV and nCPAP. Mean and 95%CI of ΔEELI over the whole lung and for four quantiles of the lung (non-gravity-dependent to gravity dependent) are shown separately.

None declared

ID 237. The DELUX study – Development of Lung volumes during extubation of preterm infants

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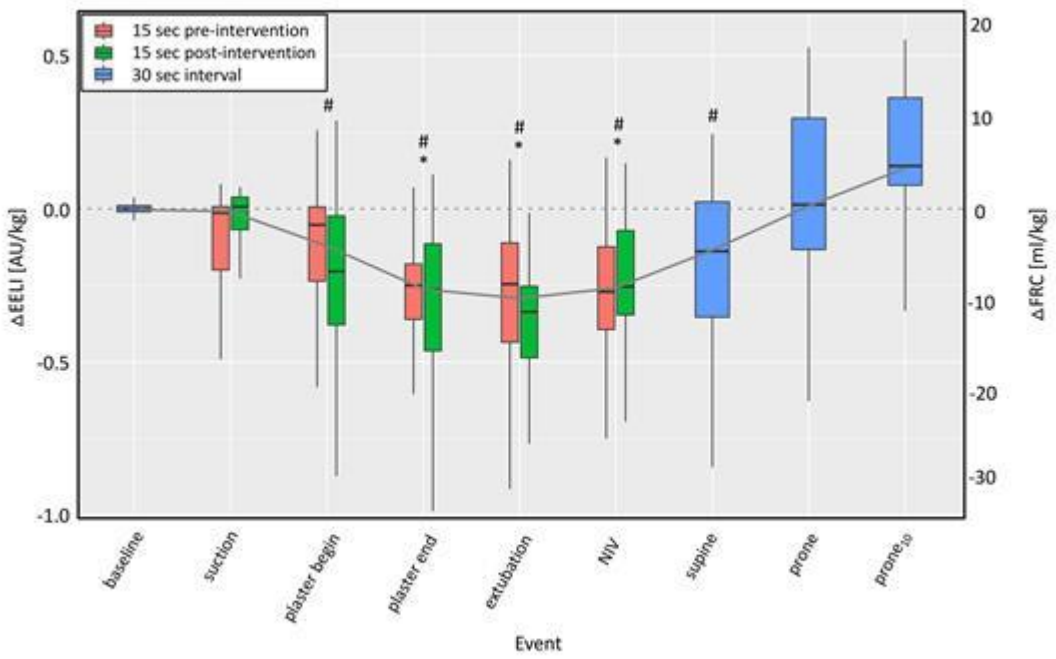
Background
Prolonged endotracheal ventilation can lead to inflammation, tissue damage and the disruption of lung development. To reduce these risks, clinicians aim to extubate preterm infants to non-invasive respiratory support as soon as possible. Prediction of successful extubation is crucial to avoid adverse outcomes associated with re-intubation. A low lung volume after extubation has been identified as an important predictor of extubation failure, emphasizing the relevance of functional residual capacity (FRC) for subsequent clinical outcomes. This study aims to measure changes in end-expiratory lung impedance (EELI) using electrical impedance tomography (EIT) as a marker of functional residual capacity (FRC) during the entire extubation procedure of very preterm infants.

Methods
Prospective observational study in preterm infants born at 26-32 weeks gestation being extubated to non-invasive respiratory support. Changes in EELI and cardiorespiratory parameters (heart rate, oxygen saturation) were recorded at pre-specified events during the extubation procedure compared to baseline (before first handling of the infant).

Results
Overall, 2'912 breaths were analysed in twelve infants. There was a global change in EELI during the extubation procedure ($p=0.029$, see figure 1). EELI was lowest at time of extubation [Median (IQR) difference to baseline: -0.30 AU/kg (-0.46; -0.14); corresponding to FRC loss of 10.2 ml/kg (4.8; 15.9), $padj=0.004$]. The biggest EELI loss occurred during plaster removal of the endotracheal tube [median change (IQR): -0.18 AU/kg (-0.22; -0.07), $padj=0.004$]. The biggest increase in EELI occurred between the positional change of the infant from supine to prone position ($padj=0.106$). After 10 minutes in prone position EELI was significantly higher compared to plaster removal and extubation ($padj=0.004$). EELI changes were highly correlated with changes in SpO2/FiO2-ratio ($r=0.48$, $p<0.001$). Forty percent of FRC were re-recruited at the tenth breath after initiation of non-invasive ventilation ($p<0.001$).

Conclusions
The extubation procedure is associated with significant changes in FRC attributable mainly to two events. Plaster removal is the major factor contributing to FRC loss during extubation and turning the infant prone after extubation is helpful in re-establishing FRC. This study provides novel information for determining the optimal way of extubating a preterm infant.



Red and green boxplots show the 15 seconds before and after the respective intervention and blue boxplots show results for 30-second intervals without intervention. EELI changed significantly (Friedman's test: p=0.029)

None declared

ID 394. Evaluation of early rescue high-frequency ventilation to very low birth weight infants

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Background:
High-frequency ventilation (HFV) uses small volumes to preserve the structure and architecture of the lung parenchyma. However, the most frequent indication is when conventional mechanical ventilation fails (severe lung conditions). In our hospital, we indicate early rescue HFV (better conditions lungs). This study evaluates the outcomes related to the early rescue to high-frequency ventilation in preterm infants.

Methods:
Patients < 1500 grams who required HFV were evaluated through a retrospective cohort study from January 2017 to December 2020.
The neonatology team performed the indication for HFV. The patients were divided into two groups according to HFV indication: early rescue group, following the institutional protocol (Mean Airway Pressure> 10 and/or Driving pressure> 14); and the control group (late rescue), which received indication only if conventional ventilation failed; late rescue (RR> 60bpm and/or driving pressure >20 cmH2O).
The variables evaluated: development of pneumothorax, presence of pulmonary hemorrhage, bronchopulmonary dysplasia (BPD), the severity of BPD, and failure of extubation, days of ventilation, death related to HFV, and severe neurological outcome(delayed neuro-psychomotor development (DNPM) and/or IVH > III/IV Volpe criteria).
To estimate the relative risks, simple and multiple log-binomial regression models were adjusted. Gender, gestational age, and antenatal steroids were the covariates. The hazard ratio was estimated using the Cox proportional hazards model to compare the groups concerning mechanical ventilation days, considering the same covariables mentioned above. The software used was R 4.0.5 and SAS 9.4.

Results:
139 children used high-frequency ventilation, with 98 newborns receiving early rescue and 41 newborns receiving late rescue. The early rescue and late rescue groups had, respectively: mean gestational age 26.1 (SD: 2.2) versus 26.4 (SD: 2.4) weeks and birth weight 777.3 g (SD: 254.6) versus 797.4 g (SD: 260.3).
There was no association between early rescue and unfavorable lung or severe neurological outcomes.
Early rescue presented as protective factor to death (AdjRR: 1.64 (1.05; 2.60))and to ventilation mechanical lenght (AdjHR: 0.66 (0.45;0.97)).

Conclusion:
The early rescue HFV to VLBW infants decreased mortality and is associated with less ventilation mechanical length.

Table 1: Multiple log-binomial regression of pulmonary and neurological outcomes according to groups.

Variables	Early rescue	Late rescue	AdiRR (IC95%)
Pneumothorax	18 (18.3%)	9 (21.9%)	1.23 (0.55; 2.74)
Pulmonar hemorrhage	32 (32.6)	11 (28.8%)	0.82 (0.41; 1.63)
BPD	15 (35.7%)	5 (38.4%)	1.19 (0.42; 3.30)
BPD moderate/severe	8(22.8%)	1(11.1%)	0,92 (0,47; 1,80)
Extubation fail	25 (36.7)	6 (28.5)	0,78 (0,32; 1,91)
Death	25 (25.5%)	18 (45%)	**1.64 (1.05; 2.60)**
Severe neurological outcomes	9 (40.9%)	1 (25%)	0,89 (0.34; 2.34)

None declared

ID 452. HFV IS AN EFFECTIVE STARTING TYPE OF RESPIRATORY SUPPORT IN ELBW PREMATURE INFANTS IN THE DELIVERY ROOM WITH SEVERE RDS: A PROSPECTIVE, RANDOMIZED, PILOT STUDY

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Background: When performing mechanical ventilation through the endotracheal tube in the delivery room, it is important to take into account the fact that the tidal volume in ELBW infants with RDS usually does not exceed 3.8 ml / kg (2.8-4.7 ml / kg). Severe surfactant deficiency determines high compliance and short time constant. It turns out that when performing mechanical ventilation in premature infants with ELBW and severe RDS, based on the physiological properties of the lungs, it is necessary to select such a ventilation mode in which a small amount of gas will enter the lungs in combination with a short inspiration time. Consequently, to ensure adequate gas exchange and maintain the necessary minute ventilation of the lungs, a frequency will be required several times higher than the average physiological one.
Objective: Comparison of two methods of initial respiratory support: high-frequency positive pressure ventilation (HFPPV) and conventional mechanical ventilation (CMV) in extremely low birth weight (ELBW) infants.
Materials and methods: prospective, randomized, pilot study, carried out in one level III perinatal center. Thirty-two ELBW babies was randomly separated in two groups: group A - HFPPV (n = 17), group B - CMV (n = 15).
Results: The recovery time for heart rate more than 100 beats per minute in group A was faster than in group B (33.9 seconds vs. 79.2 seconds; p = 0.002). Maximum FiO2 for the period of staying in hospital was significantly higher in group B (0.37 vs. 0.73; p <0.001). Mortality in CMV group was significantly higher (0% versus 27%; p = 0.038).
Conclusion: HFPPV in the delivery room in ELBW babies effectively restores heart rate, reduces the risk of lungs injury and the risk of death before discharge from the hospital.

not declare