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Abstracts

# Selected Abstracts of the 2nd Congress of joint European Neonatal Societies (jENS 2017) • Session "Neonatal Pulmonology, Neonatal Respiratory Support, Resuscitation"

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## ABS 1

## HOW SAFE IS NASAL CANNULAE OXYGEN THERAPY DURING NEONATAL TRANSPORT?

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### INTRODUCTION

High Flow Nasal Cannulae (HFNC) therapy during neonatal transport has been used as a means of non-invasive respiratory support in the West of Scotland for a number of years. However there is little published data to support the assertion that HFNC is a safe means of transporting neonates. Previous work by Boyle et al. [1] illustrated that HFNC was a well tolerated mode of respiratory support during neonatal transfers with no significant clinical deteriorations during transfer noted. However given the number of transfers performed on HFNC by the West of Scotland Neonatal Transport Team, it was felt that it would be beneficial to review our data to see if results were comparable.

### METHODS

A retrospective analysis of babies transported on HFNC by the Scotstar Neonatal West Transport Team was performed between January 2015 and December 2016 to identify any incidents that could have compromised patient care during transport. These dates were selected because in January 2015, the HFNC system was changed to a Fabian HFO system and a new comprehensive observation chart was introduced at the same time for nursing staff. This allowed accurate information to be easily and clearly documented during transport.

### RESULTS

During this period 1,624 transfers were undertaken by the team, and 127 patients were transferred using HFNC. 76% of these transfers were elective. We transferred 73 males and 54 females on our HFNC system. All patients had previously been receiving HFNC prior to transfer. The median birth weight of transferred babies was 1,674 g (540-4,660 g) and weight at transfer was 2,178 g (680-4,480 g). Median gestation at birth was 30 weeks (23-41) and gestation at transfer was 35 weeks (28-48). This combined to give a median age at transport of 36 days (0-163). The median distance travelled was 28.1 miles (2.9-173) and the median flow rate was 5.5 (2-9) with an oxygen concentration of 29.2% (21-80). There were no significant incidents identified and no babies required escalation of their respiratory support during transfer.

### CONCLUSIONS

The use of HFNC in the transport environment is a safe way of transporting babies requiring mild to moderate respiratory support. However HFNC can be prohibitive due to large gas volumes required at higher flows. Therefore each patient needs to be assessed individually regarding the appropriateness of transfer on HFNC. Given the limited volume of work around HFNC therapy in transport, it appears more data is required to supplement these findings.

### REFERENCE

[1] Boyle MA, Dhar A, Broster S. Introducing high-flow nasal cannula to the neonatal transport environment. Acta Paediatr. 2017;106(8):1363.

## ABS 2

## WEANING PREMATURE INFANTS FROM NASAL CONTINUOUS POSITIVE AIRWAY PRESSURE – CURRENT PRACTICE IN GERMANY

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### INTRODUCTION

In the past decade, a number of trials have been conducted to determine the optimal strategy of weaning premature infants from nasal continuous airway pressure (nCPAP). However, a paucity of information exists on how weaning is actually performed in clinical routine. Aim of this study was to investigate the current practice of weaning premature infants from nCPAP in Germany.

### METHODS

An online survey was performed in German tertiary care neonatal units.

### RESULTS

All 160 German tertiary care units were contacted. Replies were retrieved from 85/160 (53%) units, of which 83/160 (52%) completed the questionnaire. 66/83 (80%) respondents indicated to wean without the use of formal written policies. In 44/83 (53%) units weaning decisions are made jointly between

physicians and nurses, whereas physicians are the sole decision makers in 33/83 (40%) as are nurses in 6/83 (7%) units. Many units use more than one weaning strategy. 81/83 units (98%) gradually reduce nCPAP pressure as the initial step in the weaning process. 9/83 (11%) units stop nCPAP at standard criteria (CICADA [CeasIng nCpap At standarD criteriA] method) and 58/83 (70%) units use a cycling nCPAP on/off strategy. 52/83 (63%) of the responding units use nasal high flow (nHF) at least at some point during the weaning process, either as a gradual weaning method or while nCPAP is paused.

CONCLUSIONS

Weaning strategies from nCPAP vary widely in German tertiary care neonatal units. Different decision makers are involved and most of the units do wean on the basis of individual assessments and preferences. Noteworthy, nHF is a frequently used weaning strategy. It appears that evidence is still insufficient to promote a distinct weaning strategy, which in turn highlights the urgent need for further adequately powered clinical trials.

## ABS 3

## TIMING OF KEY EVENTS IN NEONATAL RESUSCITATION

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INTRODUCTION

Only a minority of babies need extended resuscitation at birth. International guidelines, including those of The American Heart Association and the UK Resuscitation Council, offer no recommendations on expected timings by which practitioners should achieve potentially life-saving interventions such as; endotracheal intubation, chest compressions, central venous access and emergency drug administration. Resuscitations concerning babies who die or who survive with adverse outcomes are increasingly subject to medico-legal scrutiny. Our aim was to describe real-life timings of key resuscitation milestones in an historical series of newborns that required full resuscitation at birth.

METHODS

Retrospective case note review in our tertiary-level neonatal centre covering births in the 10-year period January 2006 to December 2015. Using neonatal and maternity databases we identified all inborn babies of birth gestational age ≥ 26 weeks with a 1-minute Apgar score of 0 who, following birth, required full resuscitation in the delivery room (pre-defined as the need for positive pressure ventilation, cardiac compressions, and attempted central venous access). We interrogated their contemporaneous neonatal and maternal records for documented timings of key resuscitation milestones.

RESULTS

27 eligible babies (14 term, 13 preterm) were identified in the study period. **Tab. 1** presents timings of their key resuscitation milestones. In 4/27 (15%) umbilical venous catheterisation was unsuccessful and so the first epinephrine dose was given via the peripheral venous (n = 1), intraosseous (n = 1), or endotracheal (n = 2) route.

CONCLUSIONS

These data show timings of key resuscitation milestones in an historic series of prolonged newborn resuscitations conducted in the era of routine newborn life-support/resuscitation training. Documented timings of important resuscitation events are often lacking. The wide range of timings we present from real-life cases may nevertheless prove useful to clinicians involved in medical negligence claims.

## ABS 4

## COMPARING NON-INVASIVE VENTILATION METHODS IN RESPIRATORY SUPPORT OF PRETERM NEONATES WITH RESPIRATORY DISEASES

**Table 1 (ABS 3).** Timing of key resuscitation events.

| Key event | Median postnatal age [95% confidence interval], minutes | Milestone achieved but timing undocumented, n (%) |
|---|---|---|
| Cardiac compressions commenced (n = 27) | 2.0 [1.5-4.0], (n = 15) | 12 (44%) |
| Endotracheal intubation achieved (n = 26) | 3.8 [2.0-6.0], (n = 25) | 1 (4%) |
| Central venous access achieved (n = 23) | 9.0 [7.5-12.0], (n = 21) | 2 (7%) |
| First dose intravenous epinephrine (n = 25) | 10.0 [8.0-14.0], (n = 22) | 3 (12%) |
| First dose intravenous sodium bicarbonate (n = 17) | 12.0 [10.0-15.0], (n = 13) | 4 (24%) |
| Ongoing resuscitation measures ceased (n = 9) | 25.0 [15.0-34.0], (n = 9) | 0 (0%) |

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INTRODUCTION

Humidified heated high flow nasal cannulae (HHHFNC), nasal continuous positive airway pressure (nCPAP) and nasal intermittent positive pressure ventilation (NIPPV) are 3 nasal non-invasive ventilation methods. A prospective randomized trial study was done to compare these 3 methods for decreasing intubation and mechanical ventilation rate in preterm neonates.

METHODS

Preterm neonates with hyaline membrane disease, who were not candidate for intubation at birth, immediately received one of non-invasive nasal ventilation method and success was defined as no need for endotracheal intubation during first 72 hours. Criteria for intubation in this study were: persistent respiratory acidosis, hypoxemia, severe and repeated apnea attacks which did not respond to increasing respiratory set and so required to ventilation with bag. Brain sonography was done at 3rd postnatal day. Data of all neonates were collected until discharge day.

RESULTS

There was no significant difference between 3 randomized methods. 72% of neonates with NIPPV had successful noninvasive ventilation (35/53), comparing to 73.6% in nCPAP (39/53) and 72.2% in HHHFNC (p = 0.999). Similarly there was no significant difference between the 3 methods in total ventilation time and need for supplemental oxygen. There were no serious side effects in any of the 3 methods, except increasing IVH grade in NIPPV compared to 2 other methods (p = 0.026, 0.008). Of course nasal trauma was less in HHHFNC compared to other methods (p = 0.001).

CONCLUSIONS

Using HHHFNC at birth in preterm neonates with hyaline membrane disease is safe, however in reducing intubation rate it is not more effective than 2 other methods.

## ABS 5

## PREDICTORS AND OUTCOMES OF CONTINUOUS POSITIVE AIRWAY PRESSURE AND NASAL HIGH-FLOW TREATMENT FAILURE IN PRETERM INFANTS: A SECONDARY ANALYSIS OF A RANDOMIZED TRIAL

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INTRODUCTION

Preterm infants are increasingly managed with non-invasive ventilation (NIV), such as continuous positive airway pressure (CPAP) or nasal high-flow (HF), from birth. It remains difficult to predict which infants will require intubation and surfactant therapy. Little information is available regarding predictors of HF treatment failure. We aimed, in preterm infants 28-26 weeks' gestational age (GA), to: 1) identify clinical predictors of NIV failure; 2) describe outcomes following NIV failure; 3) identify clinical predictors of HF treatment failure.

METHODS

Secondary analysis of data from a multicentre randomised trial comparing HF with CPAP as primary respiratory support in 564 preterm infants born 28-36 completed weeks' GA [1]. "NIV failure" was defined as requiring intubation and mechanical ventilation < 72 hours from randomisation, and "NIV success" the converse. "HF treatment failure" < 72 hours was defined as in the trial. Predictive variables that were different between groups were included in a multivariable logistic regression model.

RESULTS

564 preterm infants were included: mean (SD) GA 32.0 (2.2) weeks', and birth weight 1,744 (589) g. Of these, 76 (13.5%) infants had NIV failure. On univariable analysis, infants with NIV failure had a lower GA, lower birth weight, were more often exposed to antenatal corticosteroids, were less likely to have been born after labour had commenced, and had a higher pre-randomisation fraction of inspired oxygen ($FiO_2$). Allocated treatment (HF or CPAP) did not predict NIV failure. Only GA and pre-randomisation $FiO_2$ remained significant in a multivariable analysis: area under the receiver operating characteristic curve (AUROC) 0.74. For those infants randomised to HF, HF treatment failure was predicted by lower GA, lower birth weight, being a singleton, and a higher pre-randomisation $FiO_2$. Again, only lower GA and higher pre-randomisation $FiO_2$ remained significant in a multivariable analysis: AUROC 0.76. After adjustment for GA, birth weight Z-score, and allocated treatment (HF/CPAP), NIV

failure was associated with prolonged durations of respiratory support and supplemental oxygen therapy, and nasal trauma.

CONCLUSIONS

In preterm infants ≥ 28 weeks' GA enrolled in a large trial of NIV, lower GA at birth and higher $FiO_2$ prior to randomisation predicted the need for intubation and mechanical ventilation within 72 hours, and HF treatment failure. NIV failure was associated with prolonged durations of respiratory support and supplemental oxygen, and nasal trauma.

REFERENCE

[1] Roberts CT, Owen LS, Manley BJ, Frøisland DH, Donath SM, Dalziel KM, Pritchard MA, Cartwright DW, Collins CL, Malhotra A, Davis PG; HIPSTER Trial Investigators. Nasal High-Flow Therapy for Primary Respiratory Support in Preterm Infants. N Engl J Med. 2016;375(12):1142-51.

## ABS 6

## NEONATAL NON-INVASIVE RESPIRATORY SUPPORT APPROACH: A TWO COUNTRIES COMPARISON

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INTRODUCTION

The American Academy of Pediatrics advocates the use of CPAP as first line option for respiratory failure in preterm infants at birth. Recently, among other forms of non-invasive respiratory support, nasal high flow therapy (nHFT) has gained rapidly in popularity. There is currently limited data available supporting its use as primary respiratory support in very preterm babies and no data on the best practice of weaning it.

METHODS

To compare the practices of non-invasive respiratory support and management of preterm infants at birth in two different European countries (UK and Italy). We aimed to assess the proportion of neonatal units that would start non-invasive respiratory support, as opposed to routinely intubate, and to enquire about the use and weaning of nHFT. A questionnaire was designed targeted to the use of different forms of non-invasive respiratory support used as primary respiratory support and its management in extremely preterm infants (< 28 weeks of gestation) in UK and Italy. An electronic survey was sent out by email to the lead clinicians of neonatal tertiary centers over a period of 7 months (November 2015 - May 2016). Reminder emails and telephone calls were used to optimize the response rate.

RESULTS

We identified 57 tertiary centers in UK and 115 NICUs in Italy. A total of 49 (86%) units in UK returned the questionnaire, while 103 (90%) Italian units responded. Non-invasive respiratory support instead of intubation is initiated in the delivery room (DR) by 30/49 (65%) units in UK and 87/103 (85%) in Italy. In the NICUs, 16/49 UK units (33%) use nHFT as primary respiratory support, compared to 3/103 (3%) of the Italian ones. nCPAP is used in 28/49 (57%) units in UK and in 93/103 (90%) units in Italy (**Fig. 1**). The most common starting flow rate on nHFT for both term and preterm babies is 6 L/min in UK, while in Italy 6 L/min are used in term babies

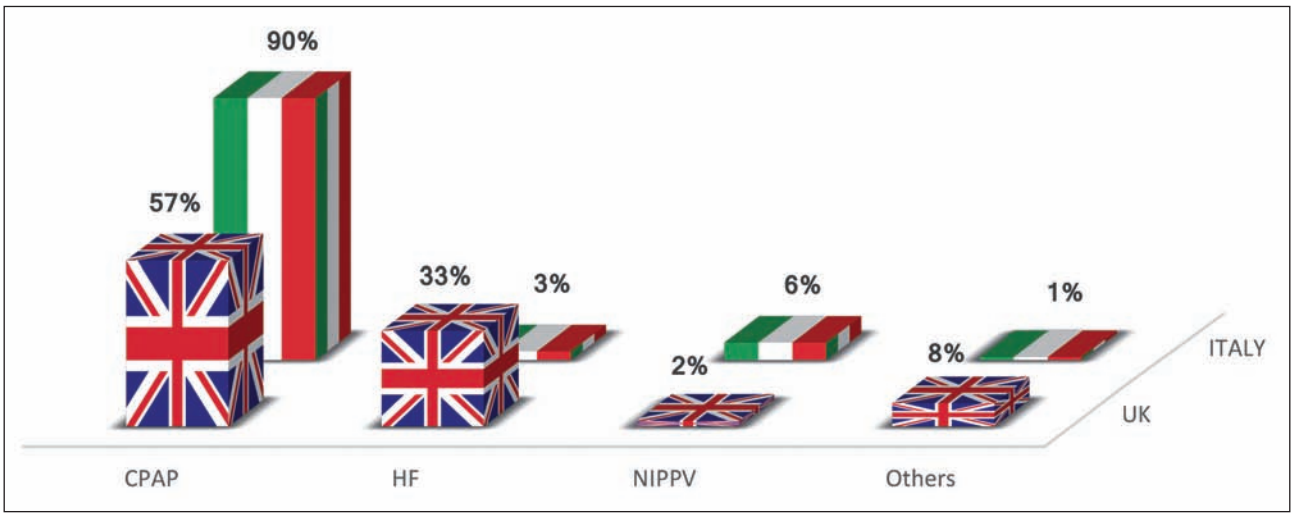


**Figure 1 (ABS 6).** Commonly used forms of non-invasive respiratory support in UK and Italy neonatal tertiary centres.

and 5 L/min in preterm infants. In UK 33/49 (67%) units decrease nHFT by 1 L/min every 24 hours, in Italy such weaning rates are used in 40/103 (39%) units predominantly for babies on nCPAP.

CONCLUSIONS

We found significant differences in the management of extremely preterm infants at or shortly after birth between UK and Italy. The different approach in the DR may influence the choice of on-going non-invasive respiratory support on NICU. Our observations may also reflect different interpretations of the current state of evidence regarding safety and efficacy of non-invasive respiratory support.

## ABS 7

## PREDICTORS OF EARLY CPAP FAILURE IN VERY LOW BIRTH WEIGHT PRETERM INFANTS

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INTRODUCTION

Most preterm infants less than 30 weeks of gestational age need some form of ventilatory support after birth to facilitate the transition to extrauterine life. The literature has shown that continuous positive airway pressure (CPAP) is a respiratory support modality that causes less lung injury without increased mortality and neurological sequelae. Studies of actions that contribute to the success of this technique are important. Some scholars have described predictors of early CPAP failure in the delivery room, however there are few studies on these predictors in developing countries.

METHODS

It was a cohort and retrospective study. Newborn included in the Brazilian Neonatal Network with birth weights of less than 1,500 grams born in the period from January 2006 to December 2015, were included in a university hospital. All newborn with malformations and those whose forms were incomplete were excluded. The study was approved by the Research Ethics Committee, under process number 1,018,827. The analyses were made using SAS 9.3 software. Two study groups were set up. The first group consisted of children who remained with CPAP in the delivery room, not requiring orotracheal intubation, and the second group of those who required intubation in the delivery room after CPAP failure. Frequencies of success and failure of using nasal CPAP in the delivery room were calculated. The crude (RR) and adjusted (RRaj) risks for the failure of early nasal CPAP were calculated by performing simple and multiple log-binomial regression models considering the following covariates: antenatal steroid use, pre-maternal hypertensive disease, occurrence of chorioamnionitis, use of antibiotics by the newborn in the first 72 hours of life, Score for Neonatal Acute Physiology Perinatal Extension II (SNAPPE-II), weight and gestational age at birth, patient temperature at neonatal intensive care unit admission and need for surfactant due to respiratory distress syndrome. The association of late outcomes such as pulmonary hemorrhage, periventricular hemorrhage, retinopathy of prematurity, patent ductus arteriosus, necrotizing enterocolitis, use of vasoactive drugs, air leak syndrome, bronchopulmonary dysplasia (BPD), and death were analyzed. Age-adjusted relative weight and gestational risk calculations and SNAPPE-II were performed using simple and multiple log-binomial regression models. The mechanical ventilation and hospitalization time were analyzed by the Wilcoxon Test.

*Definition of variables*

1. Early CPAP: early nasal CPAP was considered the one with positive final expiratory pressure between 5-6 $cmH_2O$ in the delivery room soon after neonatal resuscitation, to stabilize the newborn.
2. Early CPAP failure: failure of early nasal CPAP was considered when the child evolved with the need for orotracheal intubation in the delivery room after trying CPAP nasal.
3. Bronchopulmonary dysplasia (BPD): defined as the need for oxygen at concentrations above 21% until corrected postnatal age > 36 weeks.
4. SNAPPE-II: severity and mortality risk score for patients admitted to the Neonatal Intensive Care Unit.

RESULTS

A total of 381 newborn were included. 327 children completed the study. 54 newborns were excluded: 24 due to malformations and 30 due to incomplete forms. Group 1 consisted of 228 newborns (69.7%) and group 2 of 99 patients (30.3%). There was an association between failure of early nasal CPAP and birth weight at birth below 1,000 grams, especially with birth weights below 750 grams (RR = 1.58 [CI 95% 1.07, 2.33] and RR = 2.56

**Table 1 (ABS 7).** Association between continuous positive airway pressure (CPAP) failure and persistent ductus arteriosus (PDA), pneumothorax, retinopathy of prematurity and bronchopulmonary dysplasia.

| CPAP failure | PDA | | RR (95% CI) | RRaj (95% CI) |
|---|---|---|---|---|
| | No (%) | Yes (%) | | |
| No | 168 (74.01) | 59 (25.99) | 1.79 (1.32; 2.42) | 1.6 (1.18; 2.17) |
| Yes | 53 (53.54) | 46 (46.46) | | |
| **CPAP failure** | **PNTX** | | **RR (95% CI)** | **Rraj (95% CI)** |
| | **No (%)** | **Yes (%)** | | |
| No | 215 (95.98) | 9 (4.02) | 4.32 (1.99; 9;35) | 2.67 (1.19; 5.97) |
| Yes | 81 (82.65) | 17 (17.35) | | |
| **CPAP failure** | **ROP** | | **RR (95% CI)** | **Rraj (95% CI)** |
| | **No (%)** | **Yes (%)** | | |
| No | 145 (87.35) | 21 (12.65) | 2.68 (1.58; 4.52) | 1.90 (1.14; 3.17) |
| Yes | 43 (66.15) | 22 (33.85) | | |
| **CPAP failure** | **BPD** | | **RR (95% CI)** | **Rraj (95% CI)** |
| | **No (%)** | **Yes (%)** | | |
| No | 156 (75.00) | 52 (25.00) | 2.00 (1.46; 2.73) | 1.48 (1.05; 2.09) |
| Yes | 46 (50.00) | 46 (50.00) | | |

CPAP: continuous positive airway pressure; PDA: persistent ductus arteriosus; RR: relative risk CI: confidence interval;; RR aj: relative risk adjusted by birth weight, gestational age and SNAPPE II; PNTX: pneumothorax; ROP: retinopathy of prematurity; BPD: Bronchopulmonary dysplasia.

[CI 95% 1.77, 3.69], respectively), gestational age at birth less than 28 weeks (RR = 1.96 [CI 95% 1.43, 2.70]); SNAPPE-II greater than 20 (RRaj = 1.61 [CI 95% 1.05, 2.50]), early sepsis (RRaj = 2.32 [CI 95% 1.22, 4.42]) and the discomfort syndrome moderate and severe respiratory disease, characterized by the need for surfactant in the neonatal intensive care unit (RRaj = 1.61 [CI 95% 1.07, 2.43]). There was no association between early failure of CPAP and prenatal (RR = 0.79 [CI 95% 0.48, 1.27]), antenatal steroid use (RR = 0.97 [CI 95%: 0.66 (CI 95%: 0.56, 1.61]), type of delivery (RR = 0.83 [CI 95% 0.58, 1, 18], maternal hypertension (RR = 0.61 [CI 95% 0.43, 0.88]) and the need for vasoactive drugs in the first 72 hours (RRaj = 1.37 [CI 95% 0.89, 2.10]). With regard to late outcomes, there was an association between failure of early CPAP and air leak syndrome, retinopathy of prematurity, patent ductus arteriosus and BPD (**Tab. 1**). Group 2 children remained for longer periods on mechanical ventilation when compared to Group 1 (mean of 17.75 days vs 8.69 days). No increased risk was observed between early CPAP failure and death (RRaj = 1.12 [CI 95% 0.79, 1.59]), periventricular hemorrhage (RRaj = 1.88 [CI 95% 0.81, 4.35]) and necrotizing enterocolitis (RR = 1.15 [CI 95% 0.43; 3.08]). No significant difference was observed between the study groups regarding length of hospital stay.

## CONCLUSIONS

Birth weight less than 750 grams and gestational age less than 28 weeks at birth, SNAPPE-II greater than 20 and early sepsis are predictors of CPAP failure in the delivery room. Air leak syndrome, retinopathy of prematurity, patent ductus arteriosus, and BPD were outcomes associated with CPAP failure in the delivery room.

## ABS 8

## CHARACTERIZATION OF PORACTANT ALFA AND BUDESONIDE EXTEMPORANEOUS COMBINATION FOR SAFE AND EFFECTIVE INTRATRACHEAL ADMINISTRATION

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## INTRODUCTION

Recent clinical trials evaluated the efficacy of intratracheal (IT) administration of budesonide (Pulmicort® nebulizing suspension; AstraZeneca)

using pulmonary surfactant as a vehicle in preterm babies with severe respiratory distress syndrome (RDS). A significant reduction of bronchopulmonary dysplasia (BPD) or death was observed relative to surfactant treatment alone. This approach has promise as a pharmacological prophylactic intervention for BPD, although it requires broader preclinical characterization in terms of formulation stability, component interactions and contribution of the active principles in order to gain clinicians confidence as a therapeutic option.

METHODS

The procedure for the preparation of a homogeneous co-suspension of poractant alfa (Curosurf® Chiesi Farmaceutici S.p.A.) and budesonide was investigated. Then, in order to fully characterize the *in vitro* behavior and component interactions of the extemporary combination, structural features, stability and tensioactivity were evaluated. Ultimately, efficacy of the IT administration of the extemporary mixture in comparison with its single components was tested in two RDS animal models, premature rabbits and adult lung-lavaged rabbits managed on mechanical ventilation, by registering the acute physiological response to treatment.

RESULTS

A pre-formulation trial identified a suitable procedure to ensure the homogeneity and stability of the formulation containing budesonide 0.25 mg/kg and poractant alfa 200 mg/kg. Then, *in vitro* Wilhelmy Balance tests clarified that budesonide supplementation has no detrimental effect on poractant alfa surface tension properties. *In vivo* all surfactant-treated groups showed a significant increase of tidal volumes in preterm rabbits and of $pO_2$ in adult rabbits compared to untreated or budesonide-only treated animals. The addition of budesonide to poractant alfa did not affect the physiological response to surfactant treatment while a trend towards a better histology inflammation score was observed.

CONCLUSIONS

IT administration of a characterized extemporaneous combination of poractant alfa and budesonide proved to be safe and effective in the context of the *in vitro* and *in vivo* models studied, and it provides a potentially new therapeutic option for neonatal lung disease, subject to further evaluation.

FINANCIAL SUPPORT STATEMENT

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DECLARATION OF INTEREST

Ricci F, Machidani N, Sgarbi E, Di Lallo V, Saccani F, Pertile M, Catinella S, Puccini P, Villetti G, Civelli M, Amadei F, Aquino G, Stellari F, Pioselli B, Salomone F are employees of Chiesi Farmaceutici S.p.A. (Curosurf® , poractant alfa, owner).

## ABS 9

## LENGTH OF MECHANICAL VENTILATION AND CLINICAL FEATURES AT BIRTH IN PREMATURE INFANTS

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INTRODUCTION

Most premature infants require endotracheal intubation and mechanical ventilation (MV). MV is considered an advantage in neonatal medicine, especially in extremely premature infants. It is indicated as treatment of respiratory failure, as well as in preventing such an outcome. The prolonged length in MV is associated with morbidity and mortality and the removal of the endotracheal tube is indicated as soon as possible. The objective of this study is to associate the clinical features of premature infants with the time of permanence in MV.

METHODS

This is a prospective observational study of patients admitted to Neonatal Intensive Care Unit between 2014-2016. Some premature infants were on mechanical ventilation due to hemodynamic instability (arterial hypotension/shock), perinatal asphyxia, fatigue, apnea (by immaturity of the respiratory center), respiratory muscle failure or heart failure, but they did not present with Diffuse Parenchymal Lung Diseases (DPLD). The infants were divided into two groups according to the presence or absence of DPLD. The equipment used for mechanical ventilation in this study was Puritan Bennett™ 840®, Carlsbad, California. The study was approved by the Institution Ethics Committee. Descriptive data, Shapiro-Wilk normality test and Pearson's correlation were analyzed with Statistica®, version 10.

RESULTS

The study population comprised 55 premature infants, 29 (53%) boys, 25 (46%) girls, and one infant with undefined sex (ambiguous genitalia). The mean gestational age of the entire cohort was 28.8 ± 4.03 weeks; oxygen saturation by pulse oximetry ($SpO_2$) 94.5% ± 2.94%, median birth weight 1,158 g (485-3,230 g), mean Apgar scores

**Table 1 (ABS. 9).** Clinical conditions of patients on mechanical ventilation (n = 55).

| Condition | No. (%) |
|---|---|
| IRDS | 33 (59.9) |
| Sepsis | 7 (12.7) |
| Perinatal asphyxia | 5 (9.1) |
| Heart failure | 3 (5.5) |
| Apnea | 3 (5.5) |
| Fatigue | 2 (3.7) |
| Hemodynamic instability | 1 (1.8) |
| Pulmonary hypertension | 1 (1.8) |

IRDS: infant respiratory distress syndrome.

7 (2-10); arterial partial pressure of oxygen ($PaO_2$) 65 mmHg (25-174 mmHg) and median length in MV was 1 (1-44) days. MV was indicated for pulmonary disease in 34 (61.7%) and other clinical conditions in 21 (38.3%) (**Tab. 1**). There was no correlation between days in MV with Apgar scores, gestational age and $SpO_2$, for both groups. Length in MV correlated with birth weight ($\varrho$ = 0.426; p = 0.01) and with $PaO_2$ ($\varrho$ = -0.407; p = 0.02) in the group with DPLD.

CONCLUSIONS

Approximately half of the premature infants were in MV without DPLD. There was a trend to longer stay in MV for patients with lower $PaO_2$ but not with lower birth weight. For both diffuse parenchymal lung diseases and clinical conditions the MV is indicated, but the length in MV did not significant difference in the groups.

## ABS 10

## CONGENITAL LOBAR EMPHYSEMA MISDIAGNOSED AS PNEUMOTHORAX

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INTRODUCTION

Congenital lobar emphysema (CLE) presents a diagnostic challenge. This condition is often confused with pneumothorax, leading to intercostal drainage (ICD) insertion, an intervention that does not help; rather, it may further worsen the respiratory distress. The basic investigation in CLE is a chest radiograph. Other advanced diagnostic techniques have been utilized, included CT scan, MRI, bronchography, etc.

CASE REPORT

Through our case report we'd like to underline the importance of a high index of suspicion needed to diagnose CLE in neonates who present with a progressive respiratory distress. We describe a case of 29 days old baby who presented with respiratory distress at our PICU. From parents we learned that he has been several days with this distress and many doctors have visited him. Chest X ray was similar to a large pneumothorax. However, despite tachypnea and subcostal retraction, the clinical condition wasn't severe, like it should be in the case of acute pneumothorax. The child was laughing. He seemed accustomed to this respiratory distress. That's why at the first night of admission we haven't inserted an ICD. In the morning, after radiology conclusion for pneumothorax, we made ICD. The clinical condition deteriorated critically. CT of thorax confirmed CLE diagnosis. A surgical excision of the emphysematous lobe was performed. After surgery, clinical situation improved significantly. Actually he doesn't have signs of respiratory distress.

CONCLUSIONS

Despite advanced diagnostic techniques, CLE remain a diagnostic dilemma for pediatrician. CLE should always be considered before inserting an ICD in a suspected case of pneumothorax, especially in a neonate. Definitive diagnosis prevents complications related to unnecessary interventions such as ICD insertion. Worsening of respiratory distress and non-expansion of the lung are "eye openers" for the pediatrician.

## ABS 11

## SECRETORY PHOSPHOLIPASE A2 AND INFLAMMATION PROFILE IN PRETERM BABIES WITH RDS RECEIVING ONE OR MULTIPLE SURFACTANT DOSES

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## INTRODUCTION

Secretory phospholipase A2 (sPLA2) is known to regulate the first step of the inflammatory cascade and is able to hydrolyse phospholipids affecting surfactant function. Some surfactant components (as surfactant protein-A [SP-A] and DOPG) are able to downregulate sPLA2 expression in animal models [1, 2]. Thus, sPLA2 pathway may be related to the need for surfactant redosing in neonates with RDS and, conversely, surfactant administration might influence sPLA2 activity. No *in vivo* data are available about this issue and we aim: 1) to verify if neonates needing multiple doses have increased sPLA2 activity and inflammation; 2) to verify if surfactant administration influences sPLA2 activity.

## METHODS

This is a part of international study on sPLA2 pathway whose protocol details have been published elsewhere [3]. Babies (n = 30). Non-bronchoscopic BAL was performed before any surfactant administration and after at least 10 h from the administration, if the neonate still needed to be intubated. Multiple inflammatory mediators have been measured in BAL supernatants using Limpidex technique. sPLA2 activity has been used with radioactive method [1]. Results have been corrected for urea ratio and protein content. Data were analyzed with non-parametric statistics.

## RESULTS

sPLA2, TNF alpha, IL8 and GM-CSF are higher or tend to be higher in pre-surfactant BAL of babies needing multiple doses (**Tab. 1**). There are significant correlations between sPLA2 and TNF alpha (rho = 0.81; $p < 0.001$), IL8 (rho = 0.383; $p = 0.004$), IL1beta (rho = 0.52; $p = 0.001$), IL6 (rho = 0.3; $p = 0.002$) and GM-CSF (rho = 0.48; $p < 0.001$). sPLA2 activity is not different before (150 [12-476]) and after (129 [6-530] nmol x min / mg proteins; $p = 0.21$) surfactant administration. sPLA2 activity does not even change before (140 [34-258]) and after a second surfactant dose (150 [7-656] nmol x min / mg proteins; $p = 0.814$).

## CONCLUSIONS

Neonates needing multiple surfactant doses tend to have higher sPLA2 activity and lung tissue inflammation. sPLA2 activity is correlated with the concentration of inflammatory mediators, as already described in animal models and in older patients with ARDS [1-6]. *In vivo* surfactant administration is not able to reduce sPLA2 activity.

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## ABS 12

## SURFACTANT ADMINISTRATION AND NON-INVASIVE VENTILATION IN SURFACTANT DEFICIENCY NEWBORN PIGLETS

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**Table 1 (ABS 11).** Inflammatory mediators measured in non-bronchoscopic BAL supernatants in relation to the number of surfactant doses.

| | Single dose | Multiple doses | p |
|---|---|---|---|
| **sPLA2 (nmol x min / mg proteins)** | 142 (10-432) | 249 (31-1429) | 0.21 |
| **sPLA2/SP-A ratio (nmol x min x mL / ng) x mg proteins** | 769 (72-8869) | 4055 (559-25138) | 0.042 |
| **TNF alpha (pg/mg proteins)** | 0.23 (0.03-0.5) | 3.4 (0.23-11.4) | 0.012 |
| **IL8 (pg/mg proteins)** | 12.7 (2.7-122) | 73.3 (26-171) | 0.08 |
| **GM-CSF (pg/mg proteins)** | 0.7 (0.1-1.4) | 1.5 (0.7-2.8) | 0.0007 |

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INTRODUCTION
Nasal continuous positive airway pressure (NCPAP) and nasal intermittent positive pressure ventilation (NIPPV) as non-invasive ventilation (NIV) forms of respiratory support are being chosen increasingly as the initial treatment modality for neonates with surfactant deficiency. Our aim was to compare NCPAP with NIPPV support as the primary mode of ventilation, with or without surfactant (SF) administration.
METHODS
Twenty-four newborn piglets with SF-deficient lung injury produced by repetitive bronchoalveolar lavage were randomly assigned to NCPAP or NIPPV, with or without SF administration using the InSurE method. We evaluated the effects on pulmonary (gas exchange, lung mechanic and lung histological and inflammatory analysis) and systemic (hemodynamic and oxygen metabolism) parameters.
RESULTS
After bronchoalveolar lavage, newborn piglets developed mild respiratory distress syndrome ($FiO_2$: 1), $PaO_2$ < 70 mmHg, dynamic compliance (Cdyn) 350 and Cdyn recovered baseline values, while not SF treated groups maintained $PaO_2/FiO_2$ < 250 and Cdyn recovery was only 60-65% of basal values.
CONCLUSIONS
In newborn piglets with mild RDS, SF administration in combination with NIV is highly compatible and markedly improves pulmonary status providing additional protection against pulmonary injury.
ACKNOWLEDGEMENTS
Supported by: FIS 14/024, IT583-13 and Chiesi Farmaceutici.
DECLARATION OF INTEREST
F. Ricci, F. Bianco and F. Salomone are Chiesi Farmaceutici employees.

## ABS 13

## THE EFFECT OF MINIMALLY INVASIVE SURFACTANT THERAPY ON DIAPHRAGMATIC ACTIVITY

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INTRODUCTION
Neonatal respiratory distress syndrome due to surfactant deficiency is common in preterm infants. Minimally invasive surfactant therapy (MIST) is a method to administer exogenous surfactant directly into the lungs during spontaneous breathing. The beneficial effect of surfactant is often explained by an improvement in lung function and a decrease in breathing effort. However, this has so far not been quantified in preterm infants after MIST. Electrical activity of the diaphragm is thought to be a measure of breathing effort and can be measured by transcutaneous electromyography (dEMG). The aim of this study was to investigate the effect of MIST on diaphragmatic activity measured by dEMG.
METHODS
In this observational study, preterm infants treated with MIST were included. Transcutaneous dEMG measurement, using three skin electrodes, started 15 minutes before surfactant administration and was continued for one hour thereafter. The percentage change in dEMG activity expressed as dEMG amplitude and dEMG tonic activity was calculated at baseline (5 min before MIST) and at 15, 30, and 60 minutes after MIST. The dEMG activity and fraction of inspired oxygen ($FiO_2$) after MIST were compared to baseline using the repeated measurement Friedman's test with post hoc Dunn's test.
RESULTS
Fourteen preterm infants with a mean gestational age of 29 ± 2 weeks and mean birth weight of 1,171 ± 377 grams were included in this preliminary analysis. The dEMG amplitude and dEMG tonic activity did not change in the first hour after MIST with a median percentage change at 60 minutes of respectively 1.8% (IQR -32.6 to 10.1) and -2.8% (-34.5 to 16.9) compared to baseline. A significant decrease in median $FiO_2$ was seen from 0.64 (IQR 0.40-0.94) at baseline to 0.25 (IQR 0.21-0.30) one hour after MIST.
CONCLUSIONS
In contrast to oxygenation, breathing effort in terms of diaphragmatic activity measured by transcutaneous electromyography did not change in the first hour after minimally invasive surfactant therapy in preterm infants.

## ABS 14

## RELIABILITY AND ACCURACY OF PULSE OXIMETRY TO DETERMINE $SaO_2$ AND $PaO_2$ IN PRETERM INFANTS

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### INTRODUCTION

Monitoring oxygen saturation by pulse oximetry (PO) is one of the most frequent methods used to monitor vital signs in critically ill adults, children and infants. Optimally PO matches closely arterial oxygen tension ($PaO_2$) giving health personnel guidance in titrating oxygen supplementation correctly to minimize the risk of hyper- and/or hypoxaemia. Major neonatal morbidities such as bronchopulmonary dysplasia or retinopathy of prematurity are strictly linked to postnatal oxygen exposure. The aim of this study was to determine whether $SpO_2$ monitoring is accurate for titrating oxygen in newborn infants.

### METHODS

Peripheral oxygen saturation ($SpO_2$) readings from PO and results from blood gas analyses ($SaO_2$ and $PaO_2$) were exported five years (2010-2015) retrospectively from a patient data management system, at the Karolinska University Hospital. 27,237 paired $SpO_2$, $SaO_2$ and $PaO_2$ measurements from 1,909 individuals were analysed, while having arterial catheters in place. The $SpO_2$ target ranges for preterm infants were 88-93% (2010-2014) and 90-95% (2015).

### RESULTS

$SpO_2$ overestimated $SaO_2$ by 2.9% units (SD 5.8%). While PO readings were within the defined oxygen saturation target range 21.8% $SaO_2$ values were lower and 7.9% higher than the target range. In 57% of the cases hypoxia was diagnosed ($PaO_2$ 90%. Hyperoxia ($PaO_2$ > 11 kPa) was recorded in 19% of cases with $SpO_2$ readings below 95%. Agreement between $SpO_2$ and $PaO_2$ was good for $PaO_2$ levels > 6 kPa, but at lower levels the difference overstepped 5%, increasing with decreasing $PaO_2$ levels. The error between $SpO_2$ and $SaO_2$ increased nearly linearly with decreasing $SaO_2$ levels with a maximum error of 39% when $SaO_2$ < 50%. Sensitivity and specificity for the upper and lower limits of oxygen saturation target ranges were 0.33 and 0.03 (AUC 0.65) for 88%, 0.83 and 0.39 (AUC 0.72) for 93%, 0.42 and 0.06 (AUC 0.68) for 90% and 0.68 and 0.24 (AUC 0.72) for 95%.

### CONCLUSIONS

Titrating supplemental oxygen in preterm infants using PO to maintain $SpO_2$ within narrow oxygen target ranges is challenging as sensitivity and specificity is low at the limit values. Using arterial blood gas analysis as reference, readings from pulse oximetry do not fulfill the performance requirements for titrating oxygen supplementation in neonatal infants.

## ABS 15

## CAN WE ASSESS THE SEVERITY OF NEONATAL RESPIRATORY DISTRESS BY ULTRASOUND? A COMPARISON OF THREE METHODS

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### INTRODUCTION

Lung ultrasound (LUS) has been used to describe neonatal respiratory distress but it is not known whether LUS can estimate the severity of the disease. To this purpose, we compare a standardised LUS visual score and two computer assisted methods, i.e.:

1. the Gray scale analysis, a dedicated software that has already been used to grade pulmonary edema in mechanically ventilated adults [1];
2. the supervised machine learning approach based on the use of local descriptors followed by a Bag-of-Words paradigm, which has been shown to be successful for micro texture differentiation for biometric applications [2].

### METHODS

Neonates admitted to the NICU for respiratory distress were enrolled and clinical data were carefully recorded. Two neonatologists not attending the patients performed a lung scan, built

a single frame database and rated the images with a standardized score as follows: 0) normal pattern with horizontal reverberation of the pleural line (also known as A lines); 1) vertical hyperechoic artifacts (also known as B lines) more than 3 per field, well spaced; thin, regular pleural image; 2) coalescent B lines, thick pleural image with or without small subpleural consolidations; 3) thick and irregular pleural image with evident subpleural consolidations (**Fig. 1**). The same dataset was processed using the gray scale analysis and a supervised machine learning algorithm by a masked operator. Both the oxygenation ratio ($PaO_2/FiO_2$) and the alveolar arterial gradient (A-a) were kept as reference standards.

## RESULTS

Seventy-five neonates with different respiratory status were (birth weight = 1,380 ± 681; gestational age = 31 ± 3; $PaO_2/FiO_2$= 241 ± 108; A-a gradient = 98.5 ± 84.4) enrolled in the study and a dataset of 600 ultrasound frames was built. Visual assessment of the respiratory status correlated significantly with $PaO_2/FiO_2$ (r = -0.55; 95% C.I. = -0.68 to -0.35; $p < 0.0001$) and the A-a (r = 0.59; 95% C.I. = 0.41 to 0.69; $p < 0.0001$) with a strong inter-observer agreement (K = 0.91). Gray scale analysis with 100 thousand pixels region of interest failed to correlate with $PaO_2/FiO_2$ (r = -0.2; 95% C.I. = -0.41 to 0.02; p = 0.07) or with the A-a (0.21; 95% C.I. = -0.01 to 0.42; p = 0.3). Decreasing the size of the region of interest did not improve the results. Supervised machine learning correlated significantly with both $PaO_2/FiO_2$ (r = -0.59; 95% C.I. = -0.4 to -0.71; $p < 0.0001$) and the A-a (0.63; 95% C.I. = 0.49 to 0.75; $p < 0.001$).

## CONCLUSIONS

The visual score assessment and the supervised machine learning approach but not the gray scale analysis correlate significantly with the severity of neonatal respiratory distress in our series. Our data underline that LUS is no longer a mere descriptive imaging technique and may become a useful, radiation free tool in daily Neonatology practice.

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## ABS 16

## MATERNAL PREECLAMPSIA AND THE RISK OF RESPIRATORY DISTRESS SYNDROME IN VLBW INFANTS

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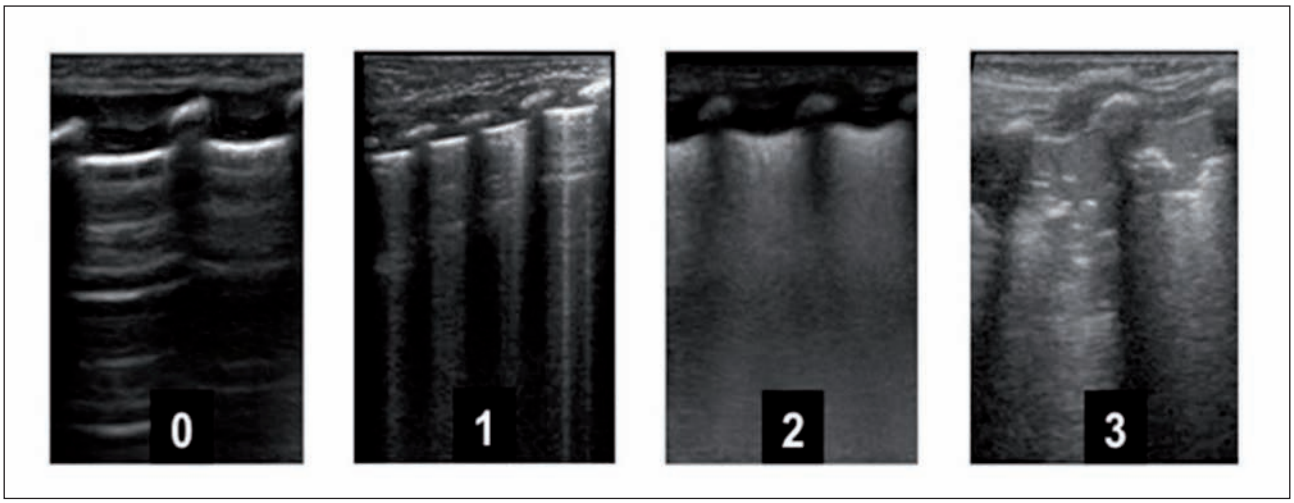


**Figure 1 (ABS 15).** Images rated with a standardized score as follows: 0) normal pattern with horizontal reverberation of the pleural line (also known as A lines); 1) vertical hyperechoic artifacts (also known as B lines) more than 3 per field, well spaced; thin, regular pleural image; 2) coalescent B lines, thick pleural image with or without small subpleural consolidations; 3) thick and irregular pleural image with evident subpleural consolidations.

INTRODUCTION
Preeclampsia is a leading cause of maternal and neonatal morbidity and mortality. In women who develop preeclampsia, the excess of soluble fms-like tyrosine kinase-1 (sFlt-1) results in decreasing free circulating levels of vascular endothelial growth factor (VEGF). Low VEGF concentration was reported to be associated with the severity of respiratory distress syndrome (RDS) in preterm infants. By contrast, preeclampsia may create a relatively stressful intrauterine environment, which could accelerate fetal maturation and result in decreased RDS rate. The relationship between preeclampsia and RDS still remains controversial. This study aims to test the relationship between preeclampsia and RDS in a cohort of premature very low birth weight (VLBW) infants.
METHODS
We conducted a retrospective cohort study assessing the association between preeclampsia and RDS in VLBW infants registered in the Premature Baby Foundation of Taiwan from 1997 to 2014. All 21 neonatal departments in Taiwan participated in the data collection. The exclusion criteria included congenital anomalies, chromosome anomalies. Severe RDS was defined by clinical diagnosis and request of surfactant therapy. The association between maternal preeclampsia and RDS was assessed using a multivariate-adjusted logistic regression model.
RESULTS
A total 13,490 infants were enrolled in this study. The overall incidence of preeclampsia and severe RDS were 16.3% (n = 2,200) and 41.2% (n = 5,559) respectively. Infants exposed to maternal preeclampsia had a lager gestational age (GA) and birth body weight (BBW) than non-preeclampsia group, but they were prone to be small for gestational age (SGA). Preeclampsia group also had higher incidence of cesarean section and female predominant, but lower incidence of RDS or severe RDS. The rate of sequentially development of bronchopulmonary dysplasia (BPD) was also lower in preeclampsia group. Subgroup analysis showed larger GA, larger BBW, female and antenatal steroid ≥ 2 use had protective effect in developing severe RDS in the non-SGA group. The protective effect of preeclampsia on developing severe RDS was obscure in the either non-SGA or SGA group. In the multivariate logistic regression analysis, the preeclampsia was insignificantly associated with the risk of developing severe RDS (odds ratio [95% CI] of 1.15 [0.95-1.40]).
CONCLUSIONS
This cohort study showed insignificant association between maternal preeclampsia and severe RDS in the VLBW infants who required surfactant therapy.

**ABS 17**

## EFFECT OF COMMERCIALLY AVAILABLE SURFACTANTS ON MORTALITY AND RESPIRATORY OUTCOMES IN PRETERM NEONATES WITH RDS: SYSTEMATIC REVIEWS AND META-ANALYSIS

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INTRODUCTION
Surfactant replacement is a cornerstone for the treatment of preterm infants with respiratory distress syndrome (RDS). Several surfactant preparations are available around the world with different biochemical characteristics. To the best of our knowledge only poractant-alfa and beractant have been extensively studied with data published in meta-analyses [1, 2]. We aimed to conduct a complex and pragmatic multiple meta-analysis comparing each commercially available surfactant preparation vs all the others in terms of mortality and respiratory outcomes.
METHODS
We searched PubMed, Google scholar, PAS abstract archive and authors' personal collections for randomized and quasi-randomized trials that comparing surfactants for treatment of established RDS in preterm neonates. The primary outcomes were death before hospital discharge, the incidence of BPD, air leaks, lung hemorrhage, the composite outcome death/BPD, the fraction of inspired oxygen ($FiO_2$) needed after surfactant administration and the need for redosing. PRISMA guidelines have been followed.
RESULTS
Twenty-three eligible trials involving 4,619 infants were included in the review and subject to the meta-analyses according to the following schema: calfactant vs all the other surfactant; beractant vs all the others; poractant alfa vs all the others; bovine lung lavage surfactant extract (bLES) vs all the others; bovactant vs all the others. Poractant alfa studies were

analysed twice: one merging all doses and another using only data from the infants treated with 200 mg/kg, as this provides a better pharmacodynamic and clinical response [3, 4]. Neonates treated with poractant alfa showed significantly less mortality/BPD (OR: 0.62; 95% CI: 0.42-0.89), BPD (OR: 0.71; 95% CI: 0.54-0.94), air leaks (OR: 0.51; 95% CI: 0.27-0.98) and need for redosing (OR: 0.48; 95% CI: 0.34-0.68). Poractant alfa also showed decreased $FiO_2$ post-administration (mean difference: -0.02; 95% CI: -0.07; -0.01), although this is coming from the comparison of only 2 trials. Results were almost identical considering data obtained with poractant alfa at 100 or 200 mg/kg. All the other comparisons between different surfactant showed non-significant differences.

## CONCLUSIONS

Poractant alfa is superior to other commercially available surfactants in terms of BPD/mortality, BPD, air leaks, need for repeated doses. A further meta-analysis will be focused on non-respiratory outcomes.

## DECLARATION OF INTEREST

D.L.D. has been a scientific consultant for Chiesi Farmaceutici S.p.A. He also received research grants for his Lab from Chiesi Farmaceutici S.p.A. This company had no role at all in this study. The other author has nothing to disclose.

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**ABS 18**

# A CLINICAL CASE OF A CHILD WITH CONGENITAL CENTRAL HYPOVENTILATION SYNDROME (CCHS) IN THE EARLY NEONATAL PERIOD

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## INTRODUCTION

We are presenting a clinical case from the Neonatology Department in Acibadem City Clinic Tokuda Hospital in Sofia, Bulgaria. It involves a newborn patient with later-on established diagnosis Congenital Central Hypoventilation Syndrome (CCHS) and our difficulties with differential diagnosis and management.

## CASE REPORT

A newborn male child, born 38 weeks of gestation, weight 3,050 g, from a second pathological pregnancy, idiopathic hydramnios and first birth by urgent cesarean section. It was hypotonic postpartum with difficult cardiopulmonary adaptation. A resuscitation was carried out. Since during the night, frequent rhythm disturbances of breathing were recorded, the child was transferred to a specialized Neonatal Intensive Care Unit. Because of the prevalent clinic of severe respiratory failure and ineffective self-respiration, the child was intubated and placed in ventilatory support with sIPPV mode. The following days the newborn maintained a stabilized general condition and in the presence of an effective self-respiration, ventilatory support was discontinued and the child was placed on respiratory support with nCPAP. In the next few days, due to a severe hypercarbia from the acid-base status, it was again intubated and placed in artificial ventilation with sIMV mode. After stabilization of the general condition and improved parameters of the ABS, repeated attempts to discontinue ventilation were without success – from the 6$^{th}$ hour after extubation up to 24$^{th}$ hour there was a severe decompensated respiratory acidosis. From day six to third month: the child remained with ineffective spontaneous breathing, with respiratory rate: 5-35/min without dyspnea. Three attempts to stop ventilation were performed. A tracheostomy was performed on fourth month of age and continued artificial ventilation mode sIPPV. From the seventh month the infant was on ventilation mode sIMV. In the meanwhile, because of the inability to establish effective breathing, the child received a multidisciplinary approach: pediatricians, neurologists, pulmonologists, cardiologists, ophthalmologists. Genetic counseling was done. Metabolic and extended genetic screening with gene sequence was performed. Two-fold a study of

CNS with MRI, EMG, EEG was performed. During the hospital stay due to clinical and paraclinical evidence of pneumonia, the child underwent a combined antibiotic therapy. Due to non-specific deviations from the metabolic screening with L-carnitine deficiency data, a supplementary therapy with L-carnitine per os was started. At five months of age a result of genetic research (sequence PHOX2B-gene), conducted by two independent laboratories revealed a mutation of the gene PHOX2B 4th chromosome and the presence of 1 normal allele (20 Ala residue) and 1 mutant allele (> 24 Ala residue) – heterozygous profile. Sequence analysis of the mutant allele revealed a duplication of the ~6 Ala residue relative to the normal allele. Genotype: 20/26.

CONCLUSIONS

CCHS is a rare disorder of central autonomic respiratory control and global dysfunction of the autonomic nervous system. These result in alveolar hypoventilation during spontaneous breathing or ventilatory dependency with the absence or reduction of a response to $CO_2$. The condition is caused by a mutation in Paired-like homeobox 2b (PHOX2B) gene. Right diagnosis provides saving these patients and improving their quality of life.

## ABS 19

## HEALTHCARE BURDEN OF BRONCHOPULMONARY DYSPLASIA AMONG EXTREMELY PRETERM INFANTS IN THE UNITED STATES

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INTRODUCTION

Bronchopulmonary dysplasia (BPD) is among the most common complications of preterm birth, with incidence increasing with lower gestational age (GA) and birth weights. We aimed to evaluate the burden of BPD among extremely preterm infants (born at GA ≤ 28 weeks) in the United States in terms of the impact on clinical outcomes and healthcare utilisation via analysis of administrative claims data.

METHODS

This was a retrospective analysis of data from the US Premier Perspective hospital claims database.

**Table 1 (ABS 19).** Demographics, clinical characteristics, clinical outcomes and healthcare utilisation.

| | BPD n = 4,904 | No BPD n = 7,113 | Overall population n = 12,017 |
|---|---|---|---|
| **GA, weeks, n (%)** | | | |
| **≤ 24** | 1,121 (22.9) | 688 (9.7) | 1,809 (15.1) |
| **25-26** | 2,036 (41.5) | 2,081 (29.3) | 4,117 (34.3) |
| **27-28** | 1,747 (35.6) | 4,344 (61.3) | 6,091 (50.7) |
| **Complications, n (%)** | | | |
| **ROP (all stages)** | 2,751 (56.1) | 3,215 (45.2) | 5,966 (49.6) |
| **IVH (any grade)** | 1,652 (33.7) | 1,841 (25.9) | 3,493 (29.1) |
| **Pulmonary complications, n (%)[a]** | 4,794 (97.8) | 6,882 (96.8) | 11,676 (97.2) |
| **Apnea** | 3,590 (73.2) | 5,333 (75.0) | 8,923 (74.3) |
| **Respiratory distress syndrome** | 4,337 (88.4) | 5,947 (83.6) | 10,284 (85.6) |
| **In-hospital mortality after 36 weeks PMA, n (%)** | 93 (1.9) | 44 (0.6) | 137 (1.1) |
| **Mean (SD) length of stay (d)** | | | |
| **Full hospitalisation[b]** | 102 (34) | 83 (24) | 91 (5) |
| **NICU[c]** | 87 (38) | 65 (31) | 74 (6) |
| **Lung-related readmissions, n (%)[d]** | 656 (13.4) | 556 (7.8) | 1,212 (10.0) |
| **Lung-related ER visits, n (%)[e]** | 623 (12.7) | 767 (10.8) | 1,390 (11.6) |

BPD: bronchopulmonary dysplasia; ER: emergency room; GA: gestational age; NICU: neonatal intensive care unit; PMA: postmenstrual age. [a]Infants may have experienced ≥ 1 pulmonary complication (percentages are not mutually exclusive); [b]length of stay in full hospitalisation includes the length of stay in NICU; [c]length of stay in the NICU was calculated based on the number of service days with NICU standard charge codes. [d]P-value (BPD vs non-BPD) < 0.001, calculated using Wilcoxon rank-sum tests for continuous variables. [e]P-value (BPD vs non-BPD) = 0.001, calculated using Wilcoxon rank-sum tests for continuous variables.

Infants born at GA ≤ 28 weeks with an admission to the neonatal intensive care unit (NICU) during birth hospitalisation, survival to 36 weeks postmenstrual age (PMA), and discharge or death at or after 36 weeks PMA, were identified during 2009-2015. Infants with zero reported costs during index hospitalisation were excluded. Cohorts were created based on presence or absence of BPD (via ICD-9-CM codes). Length of stay during index hospitalisation, in-hospital mortality, pulmonary complications/medications over the first year of life, and lung-related readmissions/emergency room (ER) visits over the first year after index hospitalisation were determined for both cohorts.

RESULTS

12,017 extremely preterm infants were included in the analysis; of these 4,904 (40.8%) had BPD and 7,113 (59.2%) did not have BPD. A higher proportion of infants with BPD (vs no BPD) had concurrent complications of retinopathy of prematurity (ROP any stage; 56.1% vs 45.2%) and intraventricular haemorrhage (IVH any grade; 33.7% vs 25.9%). Severity of ROP and IVH was generally higher among infants with concurrent BPD. BPD was also a driver for increased in-hospital mortality, and length of stay during birth hospitalisation, as well as use of pulmonary-related medications during the first year of life. There was a statistically significant difference between cohorts in lung-related readmissions (BPD: 13.4% vs no BPD: 7.8%, $p < 0.001$) and lung-related ER visits (BPD: 12.7% vs no BPD: 10.8%, $p = 0.001$) (**Tab. 1**).

CONCLUSIONS

Overall, this analysis of US claims data indicates that BPD frequently co-occurs with other complications of prematurity, and is associated with incremental increases in in-hospital mortality, length of hospital stay, use of pulmonary-related medications, lung-related readmissions, and ER visits over the first year of life.

DECLARATION OF INTEREST

This study was funded by Shire Human Genetic Therapies Inc. M. Mowitz has no disclosures in relation to this study. A. Mangili and S. Sarda are employees of and hold stock/stock options in Shire PLC. R. Ayyagari, W. Gao, and J. Zhao are employees of Analysis Group Inc., who were paid consultants to Shire Human Genetic Therapies Inc. in relation to this study. The authors thank V. Boissel, PhD, of Excel Scientific Solutions, who provided medical writing assistance funded by Shire Human Genetic Therapies Inc.

## ABS 20

## NCPAP PRESSURE AT INITIATION: IS HIGHER PRESSURE BETTER?

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INTRODUCTION

Various studies done on NCPAP as the primary mode of therapy for respiratory distress syndrome in preterm infants have used pressures varying from 4 $cmH_2O$ to 8 $cmH_2O$. On one side, though the use of higher continuous airway pressure may achieve increase splinting of the compliant chest, higher functional residual capacity and surfactant conservation but conversely, high airway pressure may also cause lung over-inflation, thereby decreasing cardiac output and increasing the chance of air leaks. There is no consensus on optimum initial nasal continuous positive airway pressure for infants on bubble NCPAP. With this background, we have conducted a prospective observational cohort study to observe if, initiating NCPAP with the pressure of 7 $cmH_2O$ leads to early achievement of adequate FRC, thereby decreasing the need of surfactant replacement therapy in comparison to initial NCPAP pressure of 5 cm of $H_2O$.

METHODS

This prospective observational cohort study was conducted in a level 3 NICU over a period of 1 year from January 2016 to December 2016, after approval from the institutional ethics committee. Infants with gestational age between 26-34 weeks having requirement of respiratory support within 24 hours of life were enrolled in this study. Selection of patients: two cohorts were formed depending on time of admission and were observed prospectively during the study period of 1 year. Group A consisted of babies screened for the inclusion criteria from January-June 2016 and was given NCPAP with initiating pressure of 5 cm of $H_2O$. Group B consisted of babies screened for the inclusion criteria from July 2016 onwards and was given NCPAP with initiating pressure with 7 cm of $H_2O$. Infant requiring respiratory distress within 24 hours of life were enrolled in this study and were started on NCPAP. We had defined, respiratory distress at initiation as Silverman-Anderson score (SAS) of > 3. Infants requiring NCPAP were given initiating pressure of 5 $cmH_2O$ as well as of 7 $cmH_2O$ depending upon their cohort allocation. Infants were closely monitored for presence of retraction and need for maximum $FiO_2$ requirement. $FiO_2$ was increased in order to achieve target saturations between

90-95% in both the groups. As per unit policy, stepwise increase in NCPAP pressure was done by 2 cm of $H_2O$ if retraction score was either 5 or 6 and by 1 cm of $H_2O$ if retraction score was 3 or 4 after 30 minutes of NCPAP. Maximum pressure was increased sequentially to a maximum of 8 cm$H_2O$ irrespective of the group allocation in our unit. Criteria for surfactant administration: surfactant (Beractant, Survanta) was given when infant had $FiO_2$ requirement > 30% persisting for more than 30 minutes, irrespective of the pressure level of NCPAP applied. The primary outcome was the need for surfactant replacement therapy.

## RESULTS

The baseline characteristics were similar between the two groups in terms of birth weight, sex, mode of delivery, need of resuscitation, Apgar score and antenatal steroid coverage (**Tab. 1**). However, only 62% of the mothers received antenatal steroid coverage in our study in both the groups. There was significantly less number of mothers having PPROM in Group A in comparison to Group B (7/61, 11% vs 18/60, 30%) (p = 0.01). However, clinical chorioamnionitis and usage of antenatal antibiotic was statistically non significant. The median time for starting NCPAP and the median Silverman-Anderson score at the start of NCPAP were similar between the two groups. There was a statistically significant higher proportion of neonates who required surfactant replacement therapy in Group A as compared to Group B (35/60, 56.6% vs 22/61, 36%) (p < 0.03). However, total days of oxygen requirement, total NCPAP duration as well as maximum $FiO_2$ requirement were not significant in our study. Although, the incidence of PDA in both the group is comparable (16/60, 26.6% versus 11/61, 18%), but we observed that age of infants in Group A at which PDA was treated pharmacologically was significantly earlier than in Group B (47.3 hours versus 75.3 hours) (p = 0.04). In terms of air leak, both the groups were comparable although there was a trend towards more chance with higher NCPAP pressures (p = 0.07). However, when we compared both the groups for first appearance of adverse event (Hyperinflation/PIE/Pneumothorax) by using Kaplan Meyer curve Log Rank ([Mantel-Cox] [p = 0.78], Breslow [Generalized Wilcoxon] [p = 0.53], Tarone-Ware [p = 0.84]), it was not statistically significant.

## CONCLUSIONS

We conclude that initiating NCPAP early with pressure of 7 cm$H_2O$ reduces the need of surfactant replacement therapy in comparison to starting with the standard pressure of 5 cm of $H_2O$. Use of high initial NCPAP of 7 cm of $H_2O$ leads to the delayed presentation of clinically significant PDA requiring pharmacological closure. Optimum initial NCPAP pressure to be used is an area of debate and we propose multicentric RCT in future.

**Table 1 (ABS 20).** Comparison of baseline characteristics in the two groups.

| | Group A (PEEP 5) (n = 61) | Group B (PEEP 7) (n = 60) | p-value |
|---|---|---|---|
| **Gestational age (weeks)** | 30.5 (2.23) | 30.5 (2.27) | 0.97 |
| **Birth weight (g)** | 1,252.9 (309.1) | 1,276.3 (350.6) | 0.69 |
| **Male** | 33 (54%) | 28 (46%) | 0.46 |
| **IUGR** | 19 (31%) | 14 (23%) | 0.64 |
| **Maternal anemia** | 13 (21%) | 8 (13%) | 0.46 |
| **PIH** | 8 (13%) | 14 (23%) | 0.11 |
| **PPROM** | 7 (11%) | 19 (31%) | 0.01 |
| **Clinical chorioamnionitis** | 6 (10%) | 11 (18%) | 0.17 |
| **Antibiotics (last dose > 4 h)** | 39 (63%) | 42 (70%) | 0.47 |
| **Steroid (full course)** | 21 (34%) | 25 (41%) | 0.45 |
| **Steroid (partial or full)** | 40 (65%) | 35 (58%) | 0.4 |
| **Vaginal deliveries** | 40 (65%) | 38 (63%) | 1.0 |
| **Resuscitation** | 22 (36%) | 19 (31%) | 0.60 |
| **Apgar score (5 min)** | 8 (7.8) | 8 (7.8) | 0.4 |
| **Age of starting respiratory support (h)** | 1.67 (0.7) | 1.64 (0.9) | 0.86 |
| **SAS (initiation)** | 4 (4.5) | 5 (4.5) | 0.63 |

SAS: Silverman-Anderson score

**ABS 21**

## TRANSPORT OF HIGH-RISK NEONATES WITH RESPIRATORY FAILURE: A SINGLE CENTER COHORT ANALYSIS BASED ON THE TRANSPORT RISK INDEX OF PHYSIOLOGIC STABILITY VERSION II (TRIPS-II)

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### INTRODUCTION

Transport of high-risk neonates with respiratory failure is characterized by a substantial risk and mortality. Therefore, close monitoring and continuous reevaluation of quality of care is essential. The Transport Risk Index of Physiologic Stability Version II (TRIPS-II) has been suggested as a valuable tool for assessing infants' illness severity, quality of care and in predicting post admission mortality. The purpose of this study was to evaluate our single center neonatal transport experience based on the TRIPS-II and compare outcomes to published data.

### METHODS

High-risk neonatal transports were analyzed retrospectively (n = 43), including neonates requiring extracorporeal membrane oxygenation (ECMO) after admission. In order to assess quality care and outcome after admission in 38 of 43 patients the TRIPS-II score was compared with outcome data from literature.

### RESULTS

Patients were transferred air-bound (n = 29, 67%) or ground-based (n = 14) from peripheral hospitals to our NICU by our dedicated transport team. All patients needed invasive, mechanical ventilation. 13 of them required high frequency oscillatory ventilation (HFOV). The mean oxygenation index (OI) was 35.6 (4-100, min-max). Two thirds (n = 27/43) of our patients needed inhaled nitric oxide (iNO), 35% (n = 15/43) required ECMO-therapy after admission. We observed two technical and four medical adverse events during transport, but no in-transport mortality. The overall mortality after admission was 33% (n = 14). Whereas none of our patients with a TRIPS-II between 0-30 died,

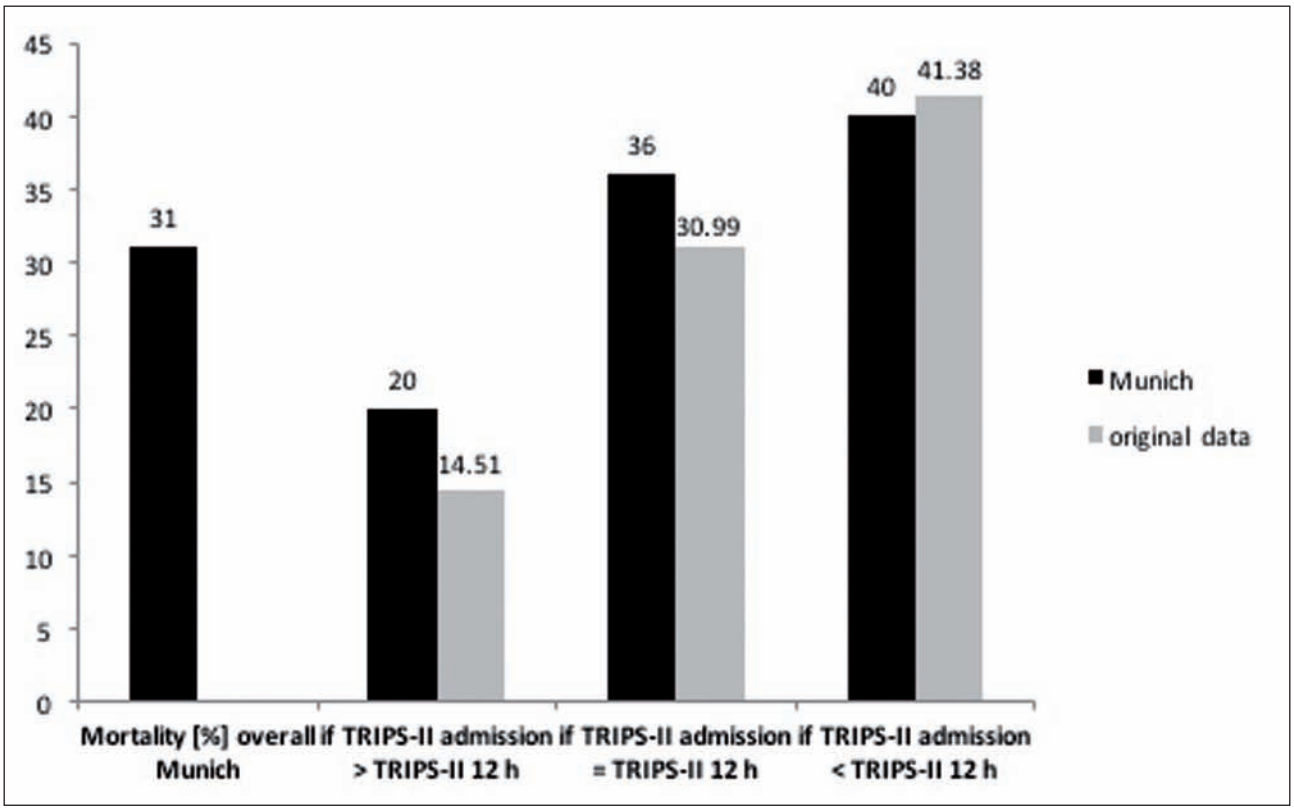


**Figure 1 (ABS 21).** Mortality related to increased, stable or decreased TRIPS-II score at 12 hours after admission.

mortality in patients with a TRIPS-II > 30 was 31% (9/29). Based on an increased, stable or decreased TRIPS-II score at 12 hours after admission, mortality in our patients was 40%, 36% and 20%, respectively (**Fig. 1**).

CONCLUSIONS

Despite specialized teams and appropriate equipment, mortality of critically ill neonates requiring transport remains high. Our data are comparable to the original TRIPS-II cohort. Therefore, TRIPS-II seems a valuable tool to assess transport quality in critically ill infants with respiratory failure.

## ABS 22

## RETROSPECTIVE AUDIT OF POSTNATAL OUTCOME OF ANTENATALLY DIAGNOSED RENAL PELVIS DILATATION

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INTRODUCTION

Improved antenatal care and screening has led to increased detection of fetal anomalies. One of the most common congenital anomalies of urinary tract is renal pelvis dilatation (RPD), occurring in 0.6-1.4% of all pregnancies. Almost 50-80% of antenatally diagnosed RPD are isolated transient upper tract dilatations, which eventually resolves over time. However, minority of them is associated with significant renal diseases and structural uropathies, which require extensive investigations and surgical interventions. The aim of this study was to determine incidence and postnatal outcomes of neonates with antenatally diagnosed RPD delivered at tertiary institution of South-East Asia.

METHODS

The study included infants with antenatal diagnosis of RPD > 5 mm after 20 weeks of gestation born during the period from January 2011 to December 2015. Postnatal evaluation was performed using a standardized departmental protocol. Postnatally, RPD was classified as mild (5-9.9 mm), moderate (10-14.9 mm), and severe (≥ 15 mm). Worsening mild RPD, moderate and severe RPD underwent radio nucleotide isotope (MAG3) scan and micturating cystourethrogram (MCU) as per departmental protocol. Outcomes evaluated were resolution of RPD, presence of structural urological anomalies and need for surgical intervention. Out of the 213 patients enrolled in the study, 16 (8.2%) defaulted antenatal or postnatal long-term follow-up resulting in final data interpretation of 197 infants.

RESULTS

RPD was isolated finding in 163 (82.7%) infants, while it was associated with calyceal dilatation in 22 (11.2%) and ureteric dilatation in 12 (6.1%). Mild RPD was present in 131 (66.5%), moderate in 45 (22.8%) and severe in 21 (10.7%) cases (**Tab. 1**). Bilateral RPD was present in 45 (33.6%) infants. By 1 year, complete resolution of RPD (<

**Table 1 (ABS 22).** Postnatal diagnosis of antenatally diagnosed renal pelvis dilatation (RPD).

| Postnatal diagnosis | Severity of RPD | | | Total n = 197 |
|---|---|---|---|---|
| | Mild (RPD 5-9.9 mm) n = 131 | Moderate (RPD 10-14.9 mm) n = 45 | Severe (RPD ≥ 15 mm) n = 21 | |
| **Isolated RPD** | 35 | 19 | 3 | 57 |
| **Partial or complete PUJO** | 4 | 9 | 10 | 23 |
| **VUR** | 1 | 2 | 2 | 5 |
| **VUJO** | 0 | 1 | 2 | 3 |
| **MCDK** | 2 | 0 | 0 | 2 |
| **PUV** | 0 | 0 | 2 | 2 |
| **Obstructed ureterocele** | 0 | 0 | 2 | 2 |
| **Duplex kidney** | 2 | 1 | 0 | 3 |
| **Horseshoe kidney** | 1 | 1 | 0 | 2 |
| **Resolution by 1 year of age** | 86 | 12 | 0 | 98 |

RPD: renal pelvis dilatation; PUJO: pelviureteric junction obstruction; VUR: vesico-ureteric reflux; VUJO: vesico-ureteric junction obstruction; MCDK: multicystic dysplastic kidney; PUV: posterior urethral valve.

5 mm) occurred in 86 (65.6%) in mild, 12 (26.7%) in moderate, and none in severe groups. Partial or complete pelviureteric junction obstruction was found in 23 cases, of which, 19 (82.6%) were from the moderate and severe groups. Structural uropathies seen in 19 (9.6%) cases which includes duplex kidney (3), horseshoe kidney (2), vesico-ureteric junction obstruction (3), multicystic dysplastic kidney (2), posterior urethral valve (2), vesico-ureteric reflux (5) and obstructed ureterocele (2). 12 (6.1%) infants needed surgical intervention for their structural urological anomalies.

CONCLUSIONS

This study provides valuable data on postnatal follow up of infants with RPD. Audit concludes that grade of antenatal RPD correlates well with severity of postnatal abnormalities, with higher rate of resolution of mild RPD. Moderate to severe RPD with additional abnormalities like dilated calyces and ureter demonstrated a greater association with postnatal urological pathologies, and need for further postnatal evaluation and surgical treatment.

## ABS 23

## CONTINUOUS POSITIVE AIRWAY PRESSURE IS NOT WELL TRANSMITTED DURING LESS INVASIVE SURFACTANT ADMINISTRATION: A PHYSIOLOGIC STUDY

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INTRODUCTION

Less invasive surfactant administration may be clinically useful and its efficacy is supposed to be partially due to the continued CPAP transmission during the procedure. No data are available about pressure delivery and the mechanical conditions during this technique. We sought to investigate the pressure delivery during less invasive surfactant administration, as we hypothesize that it might be affected.

METHODS

Physiologic *in vitro* study conducted in a mechanical ventilation laboratory, using different types of CPAP, pressure levels and degree of leaks (open or closed mouth) during less invasive surfactant administration. The model consisted of neonatal mannequin and lung carrying mechanical characteristics of respiratory distress syndrome. Pressure was measured at the lung and we then verified the results *in vivo* measuring pharyngeal pressure in stable neonates with same types of CPAP and degree of leaks. Calculations of airway resistances have been provided according to physiological data and findings coming from tracheal catheterization with non-ventilated devices in a cult critical care [1, 2].

RESULTS

Pressure delivery *in vitro* is significantly reduced during minimally invasive surfactant administration. Pressure loss is highly variable and maximal if the procedure is performed during mouth opening (99%), but it is still relevant closing the mouth (20-69%). *In vivo* measurements confirmed variable pressure drops: 53-47% and 1.5-9.3% for the mouth opening and closure, respectively. Pressure delivery was not significantly different using variable or continuous flow CPAP systems. This pressure drop occur despite the increased airway resistances causing airflow limitation as studied in adult patients. Calculations are shown in **Fig. 1**.

CONCLUSIONS

Pressure transmission during minimally invasive surfactant administration is significantly reduced, irrespectively of the type of CPAP used; mouth closure provides a better transmission but still with a significant pressure drop. Pressure drop occurs despite the increased airway resistances and the airflow limitation due to the tracheal catheterization.

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DECLARATION OF INTEREST

D.L.D. has been a consultant for Chiesi Farmaceutici and received research grant for his lab. This company had no role at all in this study.

## ABS 24

## TGFβ SIGNALING IS CRITICAL FOR REGULATING A PROXIMAL DIFFERENTIATION PROGRAM AND LUNG BRANCHING MORPHOGENESIS THROUGH ACTIVATING NOTCH SIGNALING

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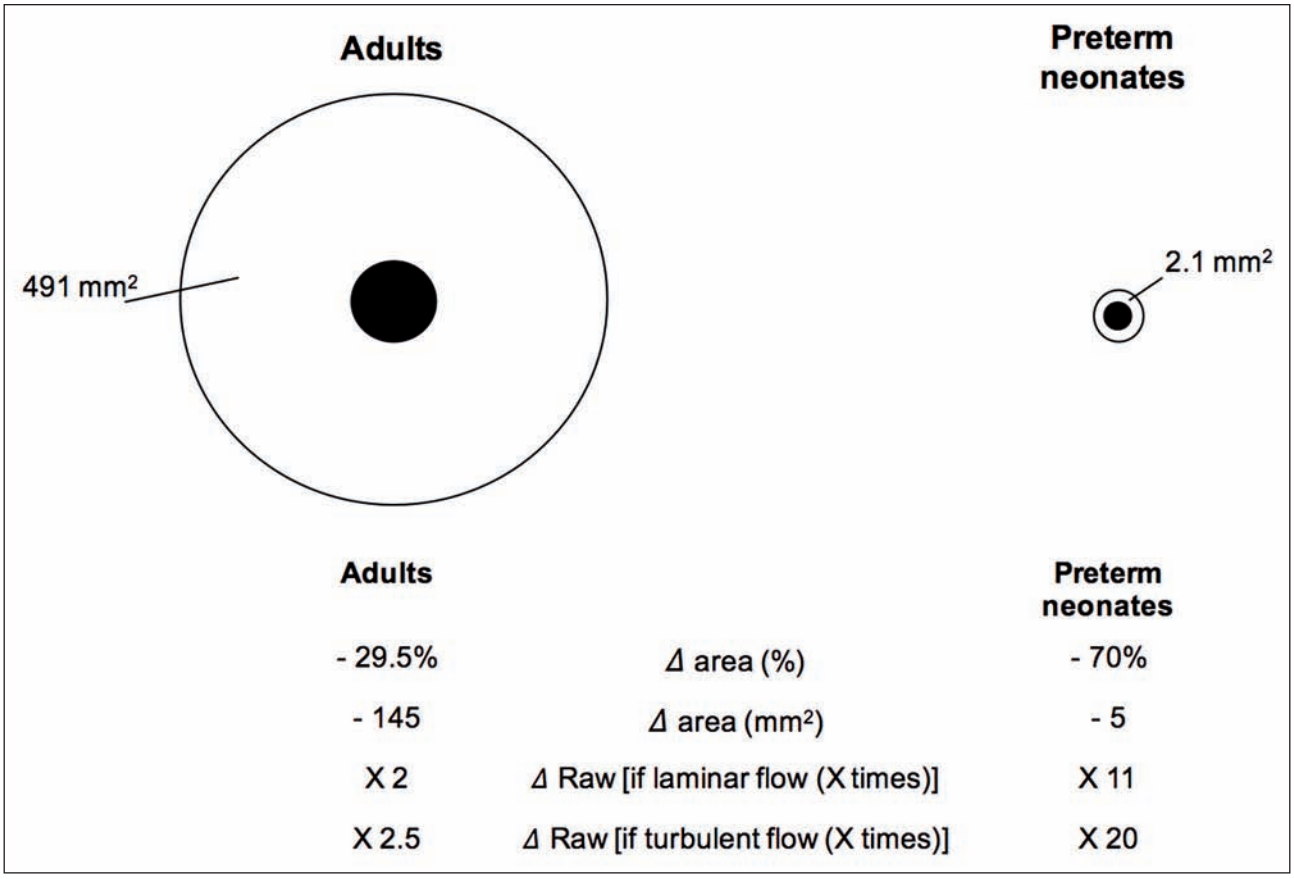


**Figure 1 (ABS 23).** A fibro-bronchoscope (4.2 mm diameter) and a feeding catheter used for less invasive surfactant administration (1.35 mm diameter) are simulated.

Tracheas and devices are represented by the outer and black inner circles, respectively; diameters are shown according to literature data [1, 2] and proportioned between them. Variations (area) in cross-sectional area and in airway resistances (Raw) during tracheal catheterization are reported. Numbers in the circles represent the cross-sectional area available for the airflow.

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## INTRODUCTION

Branching morphogenesis and proximal-distal fate decision are the key processes that control lung development. Transforming growth factor (TGF)-β signaling was known to have a negative effect on lung branching morphogenesis. However, whether TGF-β controls the proximal-distal patterning in developing lungs and the mechanism through which this occurred is unknown.

## METHODS

By using pharmacological approach, we controlled TGF-β and Notch signaling in our *in vitro* embryonic lung (E12) organ culture system to analyze the effect of TGF-β signaling and Notch interaction in lung pattern formation. Whole mount immunostaining and *in situ* hybridization was used to identify the proximal (SOX2, Dll1, TGFBI) and distal (TTF1, SOX9) domains. Western blots and real-time PCR were used to analyze the gene expression.

## RESULTS

We showed that TGF-β signaling was crucial for regulating proximal-distal boundary during lung branching morphogenesis. Disruption of TGF-β signaling prevented formation of proximal fate tubules with loss of TGFBI, SOX2 and Dll1 expression and dramatically expanded distal progenitors that express SOX9 and TTF1. This phenotype was similar to that seen in the lung explants with disruption of Notch signaling. Furthermore, activation of TGF-β sufficiently promotes proximal fate formation with less new budding in cultured lung explants and also activates Notch signaling. Strikingly, inhibition of Notch signaling partially rescues the proximalization and negative effect on lung branching by TGF-β activation.

CONCLUSIONS
TGF-β signaling not only controls lung branching, but also balances the proximal-distal epithelial cell fate during early lung development. This effect is, at least in part, through regulating Notch signaling which is critical for controlling morphogenetic boundaries in early lung development.

## ABS 25

## CHANGES IN EXPRESSION OF CONNECTIVE TISSUE GROWTH FACTOR (CTGF) IN NEWBORN RAT LUNGS AFTER VENTILATION

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INTRODUCTION
Mechanical ventilation is a common practice in the care of preterm infants with respiratory failure. However, ventilation can lead to lung injury and it is one of the main contributors in the pathogenesis of BPD. CTGF is a profibrotic factor, it is involved in lung development and it is an important player in the pathogenesis of lung fibrosis in the neonatal lung. The aim of this study was to test the hypothesis if ventilation with normal tidal volume (Vt) increases CTGF expression in newborn rat lungs.
METHODS
Newborn wistar rats (7 days old) were randomly assigned to no ventilation group (control) or ventilation group. The animals in ventilation group were anesthetized and tracheotomized and were ventilated using the HSE-HA MicroVent Model 848 Ventilator with Vt (10 mL/kg), RR 160 rpm and $FiO_2$ 0.21 for 2.5 h. We evaluated pulmonary mRNA CTGF in rat tissue lung by qRT-PCR. CTGF expression after normalization (median [IQR]) was expressed as fold increments, considering the Control group as value 1. GAPDH gene was used as internal control. Differences between groups were determined by Kruskal-Wallis test ($p < 0.05$).
RESULTS
We observed a statistically significant increase in the CTGF mRNA expression in the ventilation group: 2.65 (1.86) compared to the control group: 1.00 (0.00); $p < 0.001$.
CONCLUSIONS
Mechanical ventilation, even at normal tidal volumes, increases CTGF expression in lungs of newborn rats suggesting its involvement in lung injury in neonates.

## ABS 26

## ANTENATAL GLUCOCORTICOIDS ATTENUATE CHANGES BY VENTILATION IN EXPRESSION OF CONNECTIVE TISSUE GROWTH FACTOR (CTGF) IN NEWBORN RAT LUNG

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INTRODUCTION
Antenatal glucocorticoids are administrated to women at risk for preterm infants. An important percentage of preterm infants are exposed to mechanical ventilation. The connective tissue growth factor (CTGF) may contribute to the pathogenesis of bronchopulmonary dysplasia through ventilation-mediated injury. The aim of this study was to test the hypothesis if antenatal glucocorticoids would modulate the increase in expression of the CTGF gene produced by the ventilation.
METHODS
Dexamethasone, betamethasone or saline solution (control) was administered by parenteral way to pregnant Wistar rats on the 20th and 21st days of gestation. Newborn rats (7 days old) were anesthetized and tracheotomized and were ventilated using the HSE-HA MicroVent Model 848 Ventilator with tidal volume (Vt) (10 mL/kg), RR 160 rpm and $FiO_2$ 0.21 for 2.5 h. We evaluated pulmonary mRNA CTGF in rat tissue lung by qRT-PCR. CTGF

expression after normalization (median [IQR]) was expressed as fold increments, considering the absolute control group (newborn rats not ventilated and without antenatal glucocorticoids) as value 1. GAPDH gene was used as internal control. Differences between the groups were determined by Kruskal-Wallis test ($p < 0.05$).

RESULTS

We observed a statistically significant decrease in the CTGF mRNA expression in the antenatal glucocorticoids group, betamethasone group: 1.35 (0.75); dexamethasone group: 1.22 (0.11), compared to the control group: 2.65 (1.86); $p = 0.05$.

CONCLUSIONS

The antenatal glucocorticoids attenuate the increase of the CTGF induced by mechanical ventilation in newborn rat lung.

## ABS 27

## RELATIONSHIP BETWEEN SECRETORY PHOSPHOLIPASE A2 PATHWAY AND SHORT TERM OUTCOMES IN PRETERM NEONATES WITH RDS

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INTRODUCTION

Secretory phospholipase A2 (sPLA2) regulates the first step of the inflammatory cascade in the lung and is able to hydrolyse phospholipids affecting surfactant function. sPLA2 is known to correlate with mortality and oxygenation impairment in adults with ARDS and with dynamic compliance and the degree of ventilatory support in neonates with various types of respiratory failure [1, 2]. sPLA2 also correlates with clinical outcomes in infants with pediatric ARDS [3]. We aim to verify if sPLA2 and the molecules of its pathway are associated with short-term clinical outcomes in preterm neonates with RDS.

METHODS

This is a part of an international study on sPLA2 pathway whose protocol has been published elsewhere [4]. Babies (< 32 weeks gestation) needing surfactant replacement for RDS have been recruited. Poractant-alfa has been administered according to European guidelines. Postnatal steroids have been used only to facilitate extubation in babies beyond 14 days of life, as previously published [5]. Non-bronchoscopic BAL was performed before surfactant administration. Multiple inflammatory mediators have been measured in BAL supernatants using Luminex technique; sPLA2 activity has been used with radioactive method [1]. Results have been corrected for urea ratio and protein content. Clinical data were real time recorded in our electronic dataset and checked at the NICU discharge. Data were analyzed with non-parametric statistics.

RESULTS

Seventy-eight neonates were recruited. The duration of mechanical ventilation is significantly correlated to the sPLA2/surfactant-protein A ratio (rho = 0.321; $p = 0.014$), TNF alpha (rho = 0.483; $p = 0.008$), IL8 (rho = 0.406; $p = 0.002$), IL1beta (rho = 0.371; $p = 0.02$), IL6 (rho = 0.472; $p < 0.0001$) and GM-CSF (rho = 0.26; $p = 0.046$). NICU stay is significantly correlated with TNF alpha (rho = 0.5; $p = 0.006$), IL1beta (rho = 0.424; $p = 0.006$) and IL6 (rho = 0.291; $p = 0.027$). Neonates who needed postnatal steroids for extubation (**Tab. 1**) had higher levels of sPLA2 and related molecules. Neonates diagnosed with BPD at 36 weeks also had significantly higher sPLA2 activity (295 [70-632] vs 65 [6-449] nmol x min x mL/ng, $p = 0.05$), TNF alpha (0.4 [0.2-39] vs 0.06 [0.02-6] pg/mg proteins, $p = 0.039$) and IL6 (18 [5-206] vs 7 [2.5-35] pg/mg proteins, $p = 0.029$), than BPD-free babies.

CONCLUSIONS

sPLA2 and molecules related to its pathway are linked with relevant outcomes, such as duration of mechanical ventilation, NICU stay, need for postnatal steroids and BPD.

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**Table 1 (ABS 27).** Comparison between newborns treated or untreated with postnatal steroids.

| Postnatal steroids | Treated (8) | Untreated (70) | p |
|---|---|---|---|
| sPLA2 (nmol x min /mg proteins) | 457 [229-9,900] | 137 [12-459] | 0.08 |
| sPLA2/SP-A ratio (nmol x min x mL /ng x 1,000) | 17.9 [2.4-301] | 1.09 [1.5-8] | 0.05 |
| TNF alpha (pg/mg proteins) | 11.4 [5.5-2,467] | 0.2 [0.04-2] | 0.004 |
| IL1beta (pg/mg proteins) | 274 [2.6-1,816] | 1.6 [0.1-5] | 0.01 |
| IL6 (pg/mg proteins) | 200 [14-1,098] | 9.6 [2.7-52] | 0.015 |
| IL8 (pg/mg proteins) | 566 [42-2,598] | 32 [6-110] | 0.02 |
| GM-CSF (pg/mg proteins) | 7.5 [1.4-1,128] | 0.9 [0.2-2.7] | 0.02 |

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## ABS 28

## THE EFFECT OF ANTENATAL STEROID ON DIFFERENT GESTATIONAL AGE OF VLBW INFANT – A POPULATION STUDY

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### INTRODUCTION

As the advances in neonatal care, the survival rates of prematurity increased significantly. However, neonatal respiratory distress syndrome (RDS) remained a major problem, which caused neonatal mortality and morbidity. According to current practical guideline, antenatal corticosteroids are used for all infants delivered at gestational age between 24-34 weeks' gestation. However, the protective effect of antenatal corticosteroids on RDS at different gestational age is still unclear. In this study, we aimed to analyze the efficacy of antenatal corticosteroids in preterm infants at different gestational age.

### METHODS

We retrospectively analyzed the very low birth weight (VLBW) preterm infants registered in the Premature Baby Foundation of Taiwan from 1997 through 2014. We included VLBW infants received antenatal corticosteroids at 20-34 weeks' gestation. Premature infants with severe congenital anomaly, chromosomal anomaly, and congenital infection were excluded. The demographic characteristics including antenatal corticosteroids course were collected along with the use of Survanta as an indicator of severe respiratory distress syndrome. The effect of antenatal corticosteroids on preventing use of Survanta was evaluated according to each gestational age group.

### RESULTS

A total of 12,685 VLBW infants were included in our study. At least one complete course of antenatal corticosteroids was administrated in 5,239 infants (41.3%). In VLBW infants with gestational age between 26 to 33 weeks, completion of two doses of antenatal corticosteroids has a positive protection effect against severe RDS (odds ratio range from 0.43 to 0.60). For VLBW infants with GA less than 26 weeks and over 33 weeks, the use of antenatal corticosteroids has limited beneficial effect.

### CONCLUSIONS

Completion of one course of antenatal corticosteroids is of great importance in VLBW infants with gestational age between 26 to 32 weeks for preventing severe RDS and decreasing Survanta use.

## ABS 29

## IDENTIFICATION OF A REGULATORY ALVEOGENESIS GENE CLUSTER USING A NOVEL GENETIC APPROACH

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INTRODUCTION

Bronchopulmonary Dysplasia (BPD) is a neonatal pulmonary disorder manifested as arrested alveolar and vascular development. In addressing the mechanisms of BPD pathogenesis, elucidation of pathways and key regulatory genes governing alveolar formation has remained an intractable challenge. This information is necessary for developing effective and novel therapies not only for BPD but also for such adult lung diseases as COPD. To identify the molecular networks that regulate alveogenesis, we have developed a novel genetic-based approach.

METHODS

We generated two independent strains of mutant mice. In strain #1, TGFβ and in strain #2, PDGFA signaling were abrogated by conditional inactivation of their receptors specifically during postnatal life in Secondary Crest Myofibroblasts (SCMF), the key mesodermal cell type that drive alveogenesis.

RESULTS

Both mutations produced an identical phenotype; profound alveolar hypoplasia akin to human BPD. Analysis by RNAseq of FACS-isolated SCMFs from each mutant strain identified 624 genes (405 decreased/219 increased) in the TGFβ and 201 (143 decreased/58 increased) genes differentially expressed in the PDGFA lungs. Importantly, 117 of these genes are in common between the two mutant models. The 117 genes represent a cluster of potential candidate genes with key regulatory function in alveogenesis. Functional Grouping analysis revealed genes belonging to extracellular matrix (ECM), transcription factors and signaling molecules (ligands and receptors). The predominantly affected genes include various Integrins and ECM and many genes that regulate cell migration and movement. Many of the genes in this cluster have not been studied previously. Some represent targets of IGF1, and WNT pathways. To demonstrate the clinical relevance of this novel approach we show that the expression of the identified alveogenesis regulatory genes is indeed altered in human BPD lung samples.

CONCLUSIONS

The novel approach developed by this study represents a major advancement in understanding the molecular and genetic mechanisms that drive alveogenesis. As BPD represents arrested alveolar and vascular formation, identification of genetic regulatory elements controlling alveogenesis will help to elucidate the mechanisms of BPD pathogenesis. This information will be critical for development of effective preventive or therapeutic strategies for BPD.

DECLARATION OF INTEREST

Supported By NHLBI & The Hastings Foundation.

## ABS 30

## A COST IMPROVEMENT PROJECT: REVIEW OF THE USE OF INHALED NITRIC OXIDE (INO) IN A NEONATAL INTENSIVE CARE

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INTRODUCTION

Inhaled Nitric Oxide (iNO) is widely used to treat severe hypoxic respiratory failure with persistent pulmonary hypertension (PPHN) in term and near-term (> 34 weeks) newborns. Available evidence does not support the use of iNO in preterm neonates (< 34 weeks). Clinical response to iNO should be closely monitored as patients who do not respond should be urgently considered for extra-corporeal membrane oxygenation. Furthermore, iNO is an expensive treatment, therefore it should be used sensibly. We reviewed iNO usage in a tertiary Neonatal Unit to analyse adherence of local guidelines, treatment outcomes and estimate potential savings.

METHODS

The project was approved by the Clinical Audit & Improvement Department following a meeting with the Operational Restructuring officer for cost improvement projects. Data from 21 patients who received iNO in the Norfolk and Norwich University Hospital (NNUH) Neonatal Intensive Care Unit during a 2 year period (Sep. 2014 - Sep. 2016) was collected retrospectively from the local neonatal database. Clinical notes, online records and the national iNO Database were reviewed. Data on treatment indications, exclusion criteria (< 34 weeks, patients with pulmonary hypoplasia and patients with cyanotic cardiac defects), trial with other treatments before iNO, iNO use, effectiveness, toxicity and weaning was collected with a standardised proforma. Cost data was extrapolated from total hours of iNO therapy received.

RESULTS

76% of patients were > 34 weeks of age. Alternative therapies (rescue surfactant, inotropes and High Frequency Oscillatory Ventilation) were trailed in

71%, 95% and 76% of patients respectively before starting iNO. 8/21 (38%) patients treated did not meet the inclusion criteria to receive iNO; 3 of those 8 babies (37%) responded to treatment despite being preterm babies (**Fig. 1**). Response to iNO within the first hour was reviewed in all patients via arterial blood gas and calculation of oxygenation index (OI). However, iNO was not stopped early in 38% of patients who were not responding. The weaning protocol was followed in 86% of cases. No toxicity effects were recorded. Total cost was £48,102 over the 2 year period. Treatment response rate was 62%. The remaining 24% required ECMO and 14% passed away.

CONCLUSIONS

iNO is occasionally started on patients outside the recommended indications, sometimes with a positive outcome. Potentially, £8,000/year could be saved by stricter adherence to guidelines; this would involve carefully selecting patients who are likely to benefit from iNO and stopping iNO early if response is poor. Following discussion of results on a local meeting, an iNO treatment flowchart was implemented to optimise iNO usage and reduce costs.

## ABS 31

## IMPROVED SURVIVAL AND DECREASED INCIDENCE OF BRONCHOPULMONARY DYSPLASIA IN INFANTS LESS THAN 27 WEEKS GESTATION AFTER A RESPIRATORY CARE BUNDLE

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INTRODUCTION

There has been significant improvement in the survival rates in the very low birth weight infants (VLBW), including those with less than 27 weeks

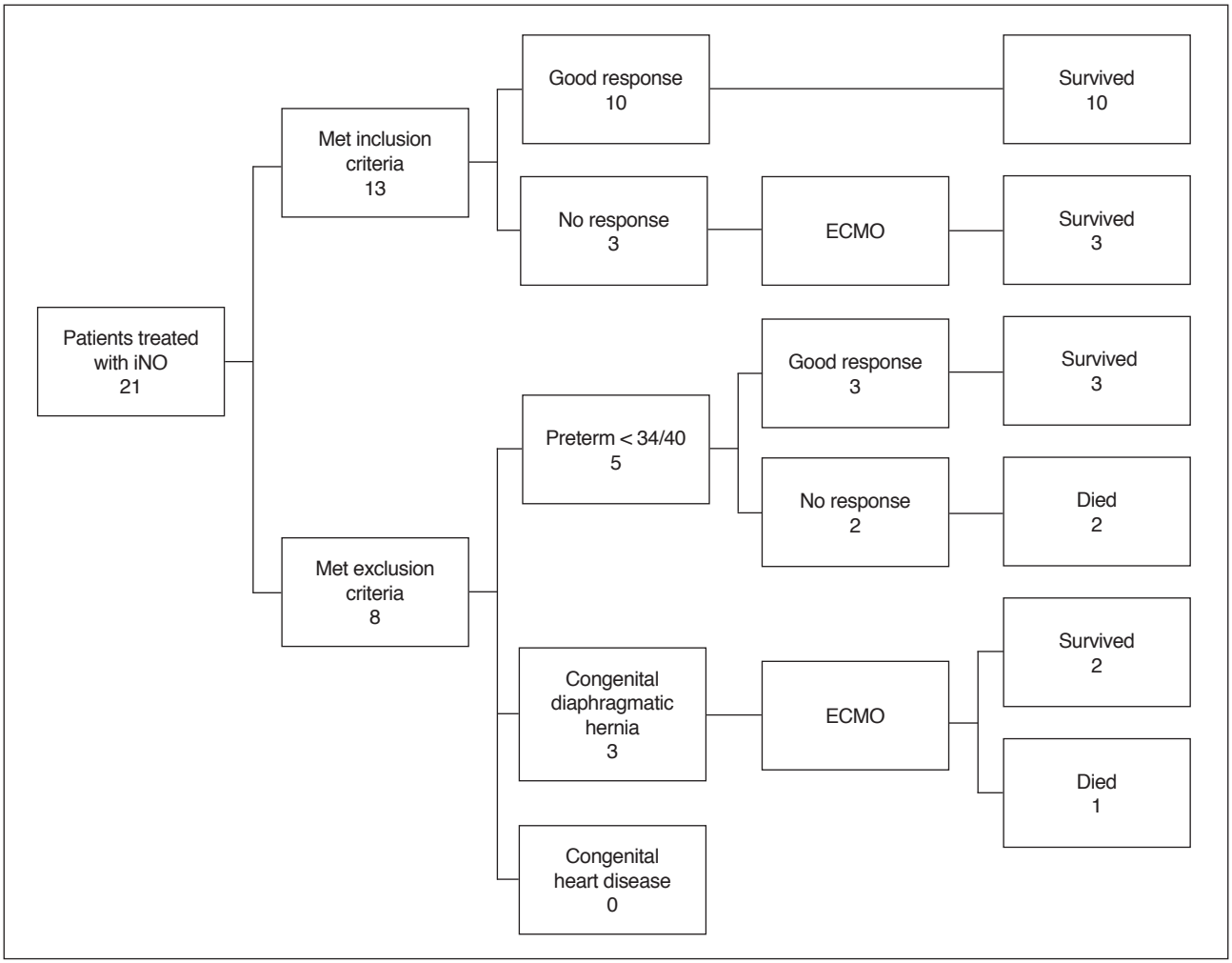


**Figure 1 (ABS 30).** Outcomes of patients treated with inhaled Nitric Oxide (iNO).

gestation in the past two decades. Unfortunately, bronchopulmonary dysplasia (BPD) remains a considerable problem in this population. We instituted a respiratory care bundle to reduce the incidence of BPD. The purpose of this study was to investigate whether a respiratory care bundle (RCB) implemented in our NICU resulted in a reduction in the incidence of BPD in infants ≤ 27 weeks gestation.

METHODS

We retrospectively reviewed the electronic medical data of all infants between 23 to 27 weeks gestation admitted to the NICU at Joe DiMaggio Children's Hospital from January 2006 through December 2015. RCB was introduced in 2010, which included increased use of prenatal and post-natal steroids, early administration of caffeine, use of the incubator with high humidity and challenges to room air in keeping oxygen saturation above 90% after 32 weeks gestation. We compared maternal and neonatal characteristics, the incidence of BPD and the survival of these infants before and after implementation of the RCB. Appropriate statistical tests were applied.

RESULTS

Six hundred forty three infants were included in the study (299 before and 344 after the implementation of RCB). There were no significant differences in maternal and neonatal characteristics. A significant ($p < 0.01$) reduction in the incidence of BPD was noted between the two periods (**Fig. 1**). This significant reduction was particularly found in infants ≤ 26 weeks gestation (**Tab. 1**). Also there was a significant increase in survival (80.0% vs 88.8%, $p < 0.01$) after the RCB.

CONCLUSIONS

A significant reduction in the incidence of BPD with improved survival was observed in infants less than 27 weeks gestation after implementation of a respiratory care bundle. Although several confounders cannot be excluded, it is likely that the decrease in rates of BPD in this population may be in part due to the changes in our clinical practice.

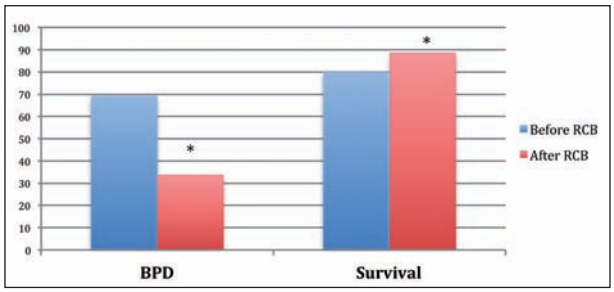


**Figure 1 (ABS 31).** Percentage of BPD incidence and survival, before and after a respiratory care bundle (RCB), in infants < 27 weeks gestation.

**Table 1 (ABS 31).** Incidence of bronchopulmonary dysplasia (BPD) before and after a respiratory care bundle (RCB) by gestational age.

| Gestational age (weeks) | BPD before RBC (n = 299) N (%) | BPD after RBC (n = 344) N (%) | p-value |
|---|---|---|---|
| **23** | 35 (90.9%) | 31 (44.7%) | < 0.01 |
| **24** | 51 (79.4%) | 80 (48.1%) | < 0.01 |
| **25** | 67 (67.9%) | 83 (31.2%) | < 0.01 |
| **26** | 61 (46.0%) | 66 (25,5%) | < 0.01 |
| **27** | 85 (35.2%) | 84 (25.1%) | 0.72 |

BPD: bronchopulmonary dysplasia; RCB: respiratory care bundle.

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## ABS 32

## VOLUME-TARGETED VERSUS PRESSURE-LIMITED VENTILATION IN NEONATES – A *COCHRANE* SYSTEMATIC REVIEW AND META-ANALYSIS UPDATED 2017

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INTRODUCTION

Lung overdistension (volutrauma) has been implicated in the development of bronchopulmonary dysplasia (BPD). Modern ventilators can target a set tidal volume (TV) as an alternative to traditional pressure-limited ventilation using a fixed inflation pressure. Volume targeting aims to produce a more stable TV in order to reduce lung damage and stabilize $pCO_2$. The primary objective was to

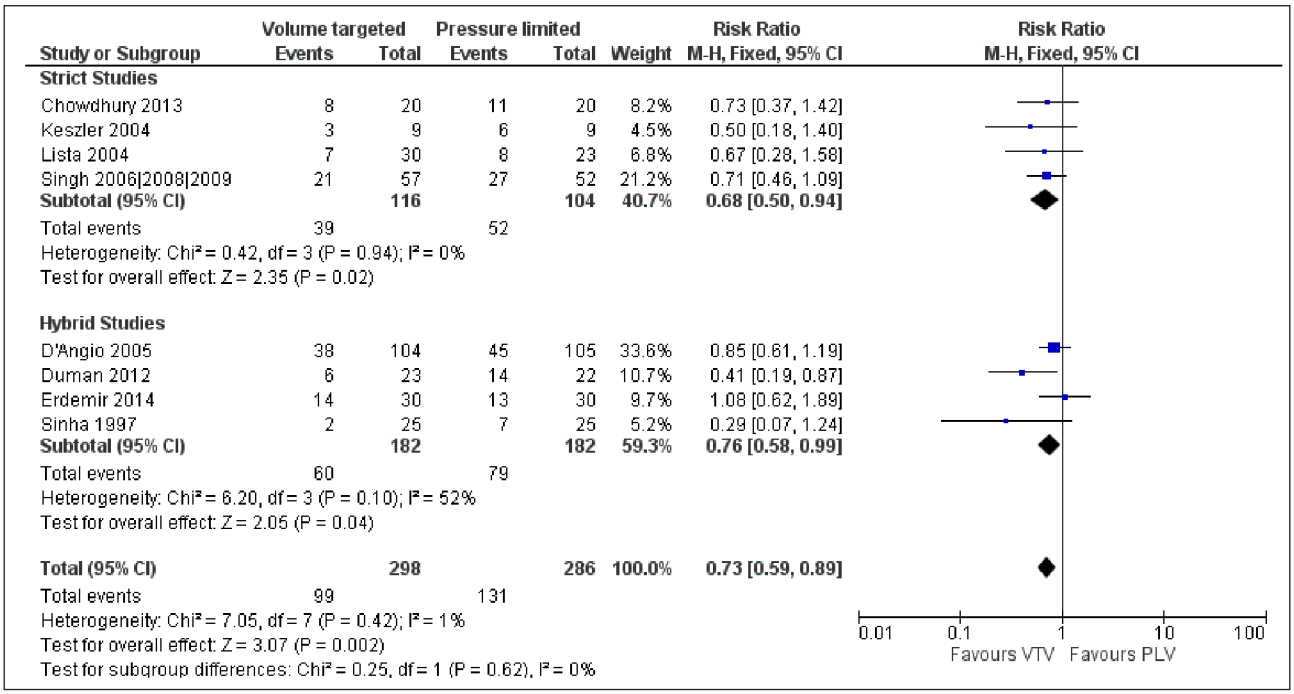


**Figure 1 (ABS 32).** Volume-targeted versus pressure-limited ventilation in neonates. *Cochrane* systematic review and meta-analysis updated 2017.

determine whether volume-targeted ventilation (VTV) compared with pressure-limited ventilation (PLV) leads to reduced rates of death and death or BPD. Secondary objectives were to determine whether use of VTV affected outcomes including blood gas results, air leak and cranial ultrasound findings.

## METHODS

We used the standard *Cochrane* methodology search strategy. Randomised clinical trials (RCTs) comparing the use of VTV versus PLV in neonates less than 44 weeks postmenstrual age and reporting relevant outcomes were included. Searches were updated to January 2017. We assessed risk of bias using the *Cochrane* handbook criteria and evaluated quality of evidence (QoE) for each outcome according to GRADE. For categorical outcomes, we calculated estimates for risk ratios (RR), risk differences (RD) and number needed to treat for an additional beneficial outcome (NNTB).

## RESULTS

Twenty RCTs were included; 16 parallel trials (977 infants) and 4 crossover trials (88 infants). We found no difference in death before hospital discharge, between VTV-modes and PLV-modes (RR 0.75 [95% CI 0.53-1.07], low QoE). The use of VTV-modes resulted in a reduction in death or BPD at 36 weeks (RR 0.73 [95% CI 0.59-0.89], NNTB 8 [95% CI 5-20], moderate QoE, see forest plot). There was moderate QoE that VTV-modes resulted in reductions in rates of the following outcomes: pneumothorax (RR 0.52 [95% CI 0.31-0.87], NNTB 20 [95% CI 11-100]), hypocarbia (RR 0.49 [95% CI 0.33-0.72], NNTB 3 [95% CI 2-5]), grade 3-4 IVH (RR 0.53 [95% CI 0.37-0.77], NNTB 11 [95% CI 7-25]) and the combined outcome of periventricular leukomalacia and/or grade 3-4 IVH (RR 0.47 [95% CI 0.27-0.80], NNTB 11 [95% CI 7-33]). VTV-modes were not associated with any increased adverse outcomes. Results are presented in **Fig. 1**.

## CONCLUSIONS

Neonates ventilated using VTV-modes had reduced rates of death or BPD, pneumothorax, hypocarbia and severe cranial ultrasound pathologies compared with infants ventilated using PLV-modes. Further studies are needed to determine whether VTV-modes improve neurodevelopmental outcomes and to compare and refine VTV strategies.

## DECLARATION OF INTEREST

Colin Morley has acted as consultant to Drager Medical, a manufacturer of neonatal ventilators. The company had no involvement with the funding, design or conduct of this review.

## ABS 33

## OXYGEN SATURATION TARGETING USING AUTOMATED VERSUS MANUAL CONTROL OF INSPIRED OXYGEN IN PRETERM INFANTS: A SYSTEMATIC REVIEW AND META-ANALYSIS

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INTRODUCTION

Preterm infants have immature lungs at birth and due to their inherent lung pathology, their oxygen saturation ($spO_2$) is often found to fluctuate widely necessitating frequent changes to the concentration of inspired oxygen ($FiO_2$). This often leads to variable periods of time spent outside the intended oxygen saturation targets. It is a well-known fact that in preterm infants, hyperoxia is associated with increased incidence of retinopathy of prematurity (ROP) and chronic lung disease (CLD) whereas hypoxia has been associated with increased mortality. There have been a number of recent studies comparing control of inspired oxygen using an automated algorithm versus manual control by health care professionals.

METHODS

To conduct a systematic review of randomized and quasi-randomized trials exploring the following question: In oxygen-dependent preterm infants who are on ventilator support (invasive or non-invasive), does automatic control of $FiO_2$ compared to manual control lead to improved $spO_2$ targeting, reduction in hypoxic events and mortality and improvement in long-term outcomes (CLD, ROP and major neurodevelopmental morbidities)? The authors searched: MEDLINE, Embase, CINAHL and PubMed, abstracts and conference proceedings and results of unpublished trials. The protocol was registered with the PROSPERO database (CRD42016036415). The risk of bias (ROB) of eligible studies was assessed according to a modified version of the *Cochrane* Collaboration's ROB tool. We assessed the confidence in the estimates for each outcome across the studies using the GRADE approach.

RESULTS

274 potentially relevant studies were identified. 10 studies including 274 infants met the inclusion criteria and were included in the final meta-analysis. 8 studies were cross-over RCTs, 1 parallel design and 1 quasi-randomized cross-over trial. Automated control of $FiO_2$ resulted in significantly higher time being spent within the target saturation range (Mean difference: 12.8%; 95% CI: 6.5 to 19.2%; $I^2$ = 90%). Periods of hyperoxia (↓ 8.8%), severe hypoxia ($spO_2$ < 80%) (↓ 1%), and hypoxic events (↓ 5.6), were significantly reduced with automated control, however, there was no difference in time spent below the target $spO_2$ range or $FiO_2$ exposure in the two groups. Sensitivity analysis to explore the source of heterogeneity revealed type of RCT and type of automated control algorithm used significantly contributed to statistical heterogeneity. GRADE assessment of quality showed that all outcomes had a very low quality of evidence except for time spent in severe hypoxia and $FiO_2$ exposure, which were of moderate quality.

CONCLUSIONS

Automated control of $FiO_2$ significantly improves $spO_2$ targeting and reduces periods of hyperoxia, severe hypoxia and hypoxic events in oxygen-dependent preterm infants. In view of the very low to moderate quality of evidence, further RCTs, preferably parallel-design and blinded, looking at patient important long term outcomes (BPD, ROP, neurodevelopment) are needed to establish a stronger evidence to routinely promote the use of automated control of inspired oxygen for preterm infants in the NICU.

## ABS 34

## DROPS IN SATURATION AND HEART RATE IN HEALTHY NEWBORNS: MORE THAN WE THINK

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INTRODUCTION

Pulse oximetry is frequently used in newborn care to monitor oxygen saturation ($SpO_2$) and heart rate in neonates. Desaturations < 92% or bradycardia < 80 bpm are often seen during routine monitoring, without obvious causes and without clinical consequences. In clinical practice, these desaturations or bradycardia can result in continuation of monitoring and thus in extended hospitalisation. In literature, little is known about the frequency of desaturations and bradycardia in healthy term and late preterm infants in the first days of life. The goal of this study is to establish reference data for heart rate and saturation in healthy term and late preterm neonates in the first days of life.

METHODS

An observational prospective cross-sectional cohort study was performed in the maternity ward of the Amphia hospital, a secondary care centre in Breda, the Netherlands. Healthy term and late preterm (GA > 35 weeks) newborn infants were included in the first 6 hours of life. After inclusion, neonates were continuously monitored by pulse oximetry with a Nellcor™ Bedside $SpO_2$ Patient Monitoring System during 24-48 hours. Parents, medical staff and investigators were blinded for the parameters during the study. The frequency, duration and level of desaturations < 92% and heart rate < 80 bpm was calculated. Subgroup analyses (i.e. mode of delivery, gestational age, birth weight, feeding) will be performed. Results are presented as median (IQR).

RESULTS

Two hundred and four healthy newborns were enrolled between April 2016 and May 2017. Two patients were excluded from analysis because of development of clinical sepsis during monitoring. The average duration of pulse oximetry measurement was 23.5 (19.8-25.4) hours. Of this, 3.8 (2.9-4.6) hours were marked as interference data by the Nellcor system and were removed from analysis. The average $SpO_2$ during measurement was 96.4 (94.9-97.3)%. All newborns had desaturations < 92%. On average, there were 270 (164-390) desaturations per newborn and 6.2 (2.9-13.7)% of the time was spent with an $SpO_2$ below 92%. The average heart rate during measurement was 125 (119-129) bpm. Fifty-one children had bradycardia below 80 bpm with an average duration of 18 (8-32) seconds. Subgroup analyses will be performed when total enrolment will be finished (expected July 2017).

CONCLUSIONS

This study is the first to show that all healthy term and late preterm newborns have desaturations below 92% in the first days of life and that 6% of time is spent below this saturation level. Also, a quarter of the newborns have bradycardia < 80 bpm. These preliminary data show that we can be more flexible regarding dips in saturation and oxygen on pulse oximetry measurement in this group of newborns.

**ABS 35**

## LUNG FUNCTION AND IgE RESPONSE ARE REDUCED IN 9 TO 10 YEARS OLD ASTHMATIC CHILDREN WITH PRETERM BIRTH

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INTRODUCTION

Spirometry is a simple and non-invasive test for assessing lung function in asthma children. It can assist in diagnosing asthma and monitoring disease severity. The aim of this study is to find out the differences of spirometry parameters and blood tests between asthmatic children with history of preterm and term birth followed at 9 to 10 years of age.

METHODS

523 asthmatic children aged 9 to 10 years, with gestational age (GA) less than 42 weeks were enrolled from the outpatient clinic of Mackay Memorial Hospital, Taipei, Taiwan, and divided into two groups. Group 1 included children with preterm birth (GA < 37 weeks); group 2 included children with term birth (GA ≥ 37 weeks). Laboratory data included serum eosinophil percentage, serum specific-IgE level to 8 allergens (Dermatophagoides pteronyssinus [Dp], Dermatophagoides farinae [Df], cat dander, dog dander, cockroach, egg white, milk, and fish). Spirometry parameters included percentage of predictive values of peak expiratory flow rate (PEFR), forced vital capacity (FVC), forced expiratory volume in the 1st second (FEV1), forced expiratory flow between 25% and 75% of FVC (FEF 25-75).

RESULTS

523 asthmatic children were composed of 329 boys and 194 girls, with mean age of 9.62 years old. 470 children completed lung function test. Serum eosinophil percentage, other specific IgE levels (cat dander, dog dander, cockroach, and fish) and some spirometry parameters (FEF 25-75, FEV1/FVC ration) are not statistically significant different between the two considered groups.

CONCLUSIONS

9 to 10 years old asthmatic children with preterm birth have worse lung function test results and lower specific IgE levels than those with term birth. Prematurity perhaps makes influences in lung function and IgE sensitization.

**ABS 36**

## TRANSFUSION-RELATED ACUTE LUNG INJURY IN PRETERM INFANTS IN THE NEONATAL INTENSIVE CARE

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## INTRODUCTION

Red blood cell transfusion (RBCT) is a common therapy in the neonatal intensive care unit (NICU). In adult medicine and the paediatric intensive care, RBCTs are associated with the development of transfusion-related acute lung injury (TRALI), which is defined as the acute onset of hypoxia, and bilateral pulmonary infiltrates, in temporal relation (within 6 hours) to a RBCT. In adults, TRALI is the leading cause of transfusion-related morbidity and mortality. The goal of the present retrospective cohort study was to determine the incidence of TRALI in the neonatal population.

## METHODS

Infants admitted to our level III NICU between January 2013 and March 2014 were included if they received at least one RBCT during hospitalization. TRALI was defined as the occurrence of acute respiratory distress syndrome (ARDS) within 24 hours of transfusion. Since neonatal criteria are not available, paediatric ARDS criteria were used. When ARDS was present before a RBCT, a predefined percentage change in oxygenation index, $PaO_2/FiO_2$ or $SpO_2/FiO_2$ ratio was calculated to delineate progressive ARDS. For transfusion characteristics RBCT episodes developing ARDS (new-onset or progressive) were compared to those that did not and for patient characteristics we compared infants that had at least one RBCT resulting in ARDS (new-onset or progressive) to those that did not.

## RESULTS

483 RBCTs were analysed in 137 infants with a median gestational age (GA) of 28 weeks and a birth weight (BW) of 1,030 grams. 46 (34%) infants had at least one RBCT episode with ARDS. In total, 92 (19%) RBCTs resulted in new-onset (34%) or progressive (66%) ARDS. RBCTs that were followed by (progressive) ARDS were significantly more often given during a critical illness like sepsis or necrotizing enterocolitis (NEC). Infants with (progressive) ARDS following RBCT were more preterm at birth and experienced significantly more complications like NEC and bronchopulmonary dysplasia (BPD). Also, mortality was significantly higher in infants that developed (progressive) ARDS after RBCT than in infants that did not. See **Tab. 1** for results.

## CONCLUSIONS

In preterm infants, RBCTs are frequently associated with new-onset (6.4%) or progressive (12.6%) ARDS. However, these findings might be confounded by indication since the majority of these RBCTs are given during periods of critical

**Table 1 (ABS 36).** Infants and red blood cell transfusion (RBCT) characteristics.

| | Infants with ARDS (n = 46) | Infants without ARDS (n = 91) | |
|---|---|---|---|
| **GA (weeks), median (SD)** | 27 (23.9-41.7) | 28.3 (24.7-41) | p = 0.03 |
| **BW (g), median (SD)** | 802 (410-4,300) | 1,123 (660-3,850) | p = 0.03 |
| **Admission for prematurity (%)** | 85 | 77 | p = 0.28 |
| **NICU length of stay (days), mean (SD)** | 41 (28) | 33 (21) | p = 0.73 |
| **Mortality (%)** | 47.8 | 17.6 | p < 0.01 |
| **Invasive ventilation (days), mean (SD)** | 10.3 (11) | 2.9 (3.9) | p < 0.01 |
| **NEC (%)** | 37 | 13.2 | p < 0.01 |
| **Patent ductus arteriosus (%)** | 52.2 | 36.3 | p = 0.07 |
| **BPD in preterm survivors (%)** | 18.6 | 7.5 | p < 0.01 |
| **Total no. RBCTs, mean (SD)** | 6.4 (3.7) | 2.1 (1.4) | p < 0.01 |
| | **RBCT with ARDS (n = 92)** | **RBCT without ARDS (n = 391)** | |
| **Volume RBCT (ml/kg), mean (SD)** | 15 (3.7) | 14.8 (2.2) | p = 0.57 |
| **Co-transfusion other blood products (%)** | 38 | 14.3 | p < 0.01 |
| **Intubation < 6 h after RBCT (%)** | 6.5 | 1.3 | p = 0.01 |
| **ARDS before RBCT (%)** | 66.3 | 40.4 | p < 0.01 |
| **Risk factor for ARDS present at RBCT (sepsis, NEC) (%)** | 76.1 | 41.2 | p < 0.01 |

ARDS: acute respiratory distress syndrome; GA: gestational age; NICU: neonatal intensive care unit; RBCT: red blood cell transfusion; NEC: necrotizing enterocolitis; BPD: bronchopulmonary dysplasia.

illness with increased risk for ARDS. Future studies should investigate if the observed ARDS is due to the RBCT alone (true TRALI), to progression of the critical illness or to the combination of both (possible TRALI).

## ABS 37

## PRETERM BIRTH REDUCES ATOPIC SENSITIZATION IN PRESCHOOL CHILDREN WITH ALLERGIC DISEASE

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### INTRODUCTION

It has been suggested that several factors during pregnancy and early childhood may influence the development of atopy. The aim of this study is to evaluate the association between prematurity and atopic sensitization in children with allergic disease in the age of 3 to 4 years.

### METHODS

A total of 1,375 patients, aged 3 to 4 years, with gestational age (GA) less than 42 weeks, and diagnosed with atopy (including asthma, allergic rhinitis and atopic dermatitis) at the outpatient Clinic of Mackay Memorial Hospital, Taipei, Taiwan were enrolled. All subjects were divided into two groups. Group 1 included children with preterm birth (GA < 37 weeks); group 2 included children with term birth (GA ≥ 37 weeks). Laboratory data included serum eosinophil percentage, serum total IgE level and specific-IgE levels to 8 allergens (including Dermatophagoides pteronyssinus [Dp], Dermatophagoides farinae [Df], cat dander, dog dander, cockroach, egg white, milk, and fish).

### RESULTS

The 1,375 children in the study included 570 females and 805 males, with a mean age of 3.75 years. Serum eosinophil percentage, other specific IgE levels (including cat dander, dog dander, egg white, milk, and fish) are not statistically significant different between these two groups.

### CONCLUSIONS

Our results showed that preterm birth have significantly lower serum levels of total IgE and specific IgE to Dp, Df and cockroach than term birth in preschool children with allergic disease. These results showed that children with allergic disease and aged of 3 to 4 years who are preterm at birth are linked with a decreased risk of atopic sensitization.

## ABS 38

## THE INCIDENCE OF RESPIRATORY MORBIDITY IN LATE PRETERM INFANT

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### INTRODUCTION

Premature births have an increased incidence in the late years, demonstrated by the growing number of late preterm (LPT) births. The incidence represents 74% from all preterm infants and 8-9% of all births, with high respiratory morbidity. Objective: the objective of the study was to elucidate the role of gestational age in the increase of neonatal respiratory morbidity in the late preterm (34-36 weeks) compared with the term newborn (39-41 weeks).

### METHODS

A retrospective study conducted on period of 4 years (from Jan 2013 till 31 Dec 2016) in a third level maternity compared the respiratory morbidity in the late preterm infants with term newborns and the respiratory therapy used.

### RESULTS

We analyzed a total of 11,949 births with a mean gestational age between 34-41 weeks, who were divided into two study groups (late preterm and term newborns). The RDS incidence was 34.2% at 34 weeks and 0.7% in term newborns. 53% of LPT compared to 31.2% of term infants were born by cesarean delivery. The incidence of transient tachypnea was 7.9% in late preterm compared with 0.5% in term newborns. Odd ratio of RDS decreased with the increase of GA up to 38 weeks compared with the 39-40 weeks group. OR at 34 weeks is 39.1; 95% confidence interval [CI], 31.0-47.3 at 38 weeks, 1.15; 95% CI, 0.9-1.4). At 37 weeks, RDS incidence increased compared with the 39-40 weeks group (adjusted OR, 3.1; 95% CI, 2.5-3.7), but at 38 weeks was less different from 39-40 weeks group. Similar incidence of TTN was greatly increased at 34 weeks (14.7; 95% CI, 11.7-18.4) compared with the 38 weeks (1.0; 95% CI, 0.8-1.2); neonatal pneumonia incidence was 5.4% (95% Cl 6.9-16.1) at 34 weeks and 0.4% (95% CI, 0.6-1.2).

The need for ventilator support was 7.5% at 34 weeks, 0.2% after 38 weeks.

CONCLUSIONS

Respiratory distress syndrome remains a common disease of the late preterm infants, the severity is increasing with the decrease in gestational age. Respiratory morbidity for this age includes: neonatal transient tachypnea, deficit/inactivation of surfactant and pulmonary hypertension. Caesarean section without labor increases the risk for this disease with decrease in gestational age and the need for ventilatory support is higher in LPT infants.

## ABS 39

## HELPING BABIES BREATHE, SECOND EDITION: STRENGTHENING THE PROGRAM TO INCREASE GLOBAL NEWBORN SURVIVAL

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INTRODUCTION

Helping Babies Breathe (HBB), a skills-based program in neonatal resuscitation for birth attendants in resource-limited settings, has been implemented in over 80 countries since 2010. Population-based implementation studies of HBB in Tanzania, Kenya, Nepal and India have shown significant reductions in fresh stillbirth and first-day neonatal mortality, especially when incorporating low-dose, high-frequency (LDHF) practice and quality improvement. For the first of planned every-5-year revisions, the objective was to strengthen the program and increase its impact on neonatal survival by updating scientific content, improving educational efficiency, and addressing implementation challenges.

METHODS

The Formula for Survival (medical science x educational efficiency x local implementation = survival) provided a framework for evidence underlying the revisions. The 2015 ILCOR Neonatal Resuscitation Consensus on Science with Treatment Recommendations formed the basis for scientific updates. Published literature and program reports, especially from the HBB Global Development Alliance, consensus guidelines on reprocessing equipment, systematic collection of suggestions from frontline users, and responses to a semi-structured online questionnaire, informed educational and implementation revisions. Draft materials underwent Delphi review and field testing in India and Sierra Leone. An Utstein-style meeting of stakeholders in June 2015 identified key actions for successful implementation.

RESULTS

Scientific revisions included adoption of expectant management of infants with meconium-stained amniotic fluid, limitation of suctioning to situations when needed, emphasis on good chest movement and continuation of ventilation until onset of spontaneous respirations. Frontline users (n = 102) suggested simulation methods to build confidence/competence in resuscitation skills, plus more guidance to program leaders/facilitators on implementation. Users identified a need for additional/sufficient time for practice during the workshop, systematized ongoing practice after the workshop, and enough mannequins per participant. Field trials refined educational approaches to self-reflection, feedback and debriefing, as well as new content around quality improvement. Utstein meeting stakeholders validated the importance of quality improvement and use of data to improve outcomes.

CONCLUSIONS

HBB 2nd Edition emphasizes practice during workshops, incorporates self-reflection, feedback and debriefing to reinforce learning, and promotes mentoring and development of facilitators, systems for LDHF practice in the facility, and quality improvement around resuscitation. Freely downloadable materials at hbs.aap.org make these evidence-based updates accessible to users worldwide who are working toward global newborn survival goals.

## ABS 40

## EXPRESSION OF THE HYALURONAN RECEPTOR RHAMM IN BRONCHIOLAR EPITHELIUM OF NEONATES NEGATIVELY CORRELATES WITH AIR CONTENT IN THE LUNG

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INTRODUCTION

The receptor for hyaluronan-mediated motility (RHAMM) is expressed in endothelial cells, fibroblasts, smooth muscle cells, and immune cells. It regulates signaling pathways that influence cell motility, and proliferation in inflammatory and tumorigenic responses. The role of RHAMM in fetal lung development is not well established. The aim was to understand the role of hyaluronan (HA) content and RHAMM expression in postnatal lung development by analyzing human lung specimens from ventilated newborn infants at different gestational and postnatal ages with a variety of different lung diseases.

METHODS

Postmortem lung samples were analyzed from infants born 1990-1996, at a postnatal age of 0-228 days. Seventy-six infants were born before term (81%) and 18 at term (19%), at gestational age 23-41 weeks. Immunohistochemistry was performed with antibodies for RHAMM. Ten images per lung sections were assessed by light microscope. Analysis of 940 digital images was performed by Image J software. IHC Toolbox plugin in Image J was used for color detection of DAB staining, which corresponded to RHAMM expression. Expressions in whole lung tissue and in bronchiolar epithelium specifically were analyzed separately. The fraction of the parenchyma-covered area in the lung section allowed for descriptive analysis of the air content of the lung.

RESULTS

A negative correlation was observed between air content and RHAMM expression in the bronchiolar epithelium. Higher air content appeared together with lower RHAMM expression in the bronchiolar epithelium in all samples studied (**Fig. 1A**), however independently of changes in total RHAMM expression of the whole lung tissue (**Fig. 1B**). Artificial modifications of air content during tissue preparation and fixation procedure could thereby be excluded. Changes in air content were not correlated to other parameters such as gestational age, weight or postnatal age.

CONCLUSIONS

Other studies have shown that pathologically high levels of stretching during ventilation can initiate epithelial mesenchymal transition (EMT) due to enhanced HA production in epithelial cells, which can lead to lung fibrosis. RHAMM expression can be induced by HA production. This mechanism might be a link between structure changes in the lung resulting in the lower air content and the higher RHAMM expression in the airway epithelium in the present study.

## ABS 41

## SUDDEN VERSUS PRESSURE WEAN FROM NASAL CPAP IN VERY PRETERM INFANTS: A MULTICENTER RANDOMIZED CONTROLLED TRIAL

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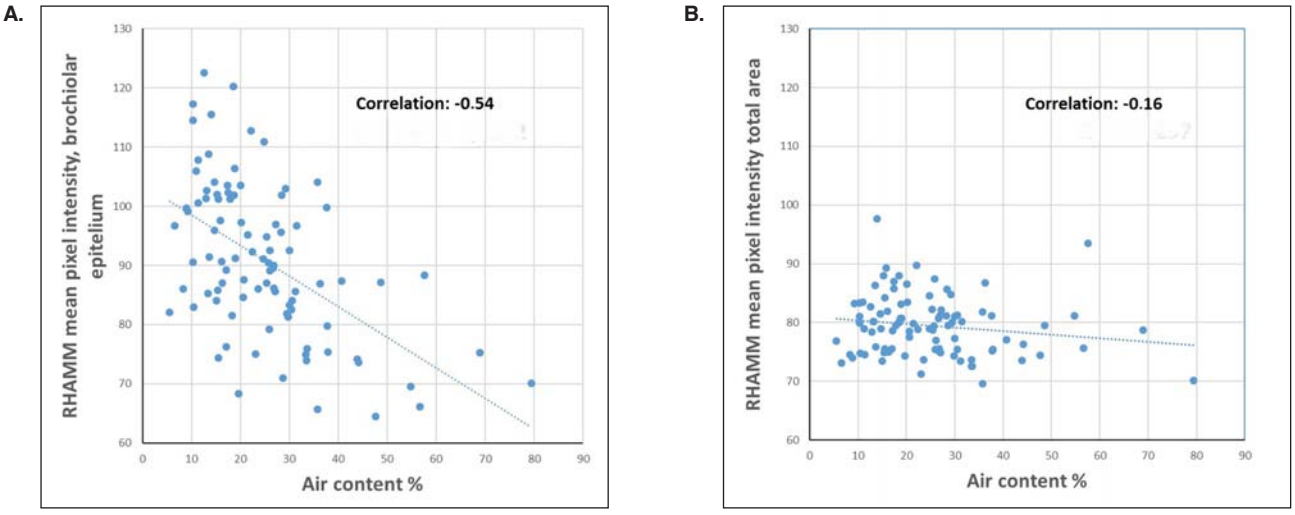


**Figure 1 (ABS 40).** Air content and RHAMM expression in the bronchiolar epithelium (**A**), and in the whole lung tissue (**B**).

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INTRODUCTION

Nasal Continuous Positive Airway Pressure (nCPAP) is a widely accepted method used in the care of preterm infants with respiratory distress syndrome. Three main methods of nCPAP weaning exits, namely graded-time off wean, pressure wean and sudden wean. Graded-time off wean has been associated with increased pulmonary morbidity compared to pressure wean and sudden wean. We aimed to investigate pressure wean compared to sudden wean from nCPAP in infants born before 32 weeks of gestation.

METHODS

A multicenter parallel randomized, controlled, open label trial was conducted at six neonatal intensive care units (NICU). Infants < 32 weeks of gestation requiring nCPAP for > 24 hours were eligible. When specific criteria were fulfilled infants were randomized to either pressure wean (reduction in pressure by 1 $cmH_2O$/24 h until 4 $cmH_2O$) or sudden wean (abrupt nCPAP discontinuation). The primary outcome was difference in weight gain (g/kg/day [mean ± SD]) at 40 weeks postmenstrual age (PMA). Secondary outcomes were differences in weight gain during nCPAP weaning, PMA at successful wean, duration of nCPAP and oxygen therapy, length of stay in the NICU, successful wean in first attempt, bronchopulmonary dysplasia (BPD) and discharge from the NICU with home oxygen.

RESULTS

372 infants were included. 187 were randomized to pressure wean and 185 infants to sudden wean. The weight gain from initiating wean to 40 weeks PMA were 22 g/kg/day ± 6 for pressure wean and 22 g/kg/day ± 6 for sudden wean. There was no difference between the pressure and sudden wean group for all secondary outcomes, except for BPD and discharge from the NICU with home oxygen. In the sudden wean group 46 (25%) infants were diagnosed with BPD compared to 35 (19%) infants in the pressure wean group and more were discharged with home oxygen (3 versus 0), but both results were statistically insignificant.

CONCLUSIONS

There were no difference in weight gain or any of the secondary outcomes between pressure and sudden wean from nCPAP in very preterm infants. Although not powered specifically to study BPD, we found that more infants in the sudden wean group were diagnosed with BPD and discharged with sustained oxygen need.

## ABS 42

## BIPAP REDUCES EXTUBATION FAILURE IN THE FIRST WEEK COMPARED TO CPAP IN NEONATES < 30 WEEK OF GESTATIONAL AGE WITHOUT INCREASED RISK OF PNEUMOTHORAX

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INTRODUCTION

Noninvasive respiratory support for neonates is a strategy allowing to reduce the adverse effects associated with ventilation trough endotracheal tube. Many efforts are performed from neonatologists to reduce the duration of mechanical ventilation in favor of a less invasive form of respiratory support and to improve the rates of successful extubation, with the final goal to reduce the incidence of bronchopulmonary dysplasia. In literature it has been showed that higher distending pressures are needed post-extubation for the more immature infants on nasal continuous positive airway pressure (CPAP); on the other hand, the higher pressure is used on CPAP, the higher the risk of pneumothorax. This study compares the effectiveness of CPAP versus bi-level nasal continuous positive airway pressure (BIPAP) at higher MAP than CPAP as post extubation respiratory support in neonates < 30 weeks of GA at birth with respiratory distress syndrome and the occurrence of pneumothorax.

METHODS

Neonates < 30 weeks of GA, born from January 2009 to December 2015, intubated at birth and included in the Vermont Oxford Network (VON) database were enrolled in a retrospective cohort study.

Our primary outcome was to compare the failure of CPAP versus BIPAP as post extubation respiratory support within the first week from extubation and the occurrence of pneumothorax during CPAP or BIPAP (CPAP group: n = 89, PEEP 4-5 $cmH_2O$; BIPAP group: n = 45, PEEP 4-5 $cmH_2O$, rate 10-40; thigh 0.7-1; upper pressure level 8-10 $cmH_2O$ generating a MAP of 6-8 $cmH_2O$). Secondary outcomes investigated between the two study groups were rate of failure of CPAP versus BIPAP after 1

week from extubation, periventricular leukomalacia (PVL), bronchopulmonary dysplasia (BPD), sepsis, patent ductus arteriosus (PDA) and retinopathy of prematurity (ROP) at discharge.

RESULTS

134 neonates < 30 weeks of GA were studied. No statistically significant difference was noted in patients' characteristics between the two groups. Rate of failure of CPAP group within the first week after extubation was significantly higher compared with BIPAP group: 5/45 (10%) in the BIPAP group vs 23/89 (25%) in the CPAP group (p = 0.05). The BIPAP group received a higher MAP (6-8 $cmH_2O$) when compared with CPAP group without experienced higher occurrence of pneumothorax. No differences between groups were found regarding secondary outcomes included rate of failure of the noninvasive respiratory support after the first week from extubation.

CONCLUSIONS

In this study, we observed a lower rate of failure of noninvasive respiratory support within the first week after extubation in patients treated with BIPAP versus neonates treated with CPAP. Neonates treated in BIPAP received higher MAP without increase in pneumothorax occurrence. These preliminary results can suggest the effectiveness and safety of BIPAP after extubation in infants < 30 weeks of GA. Further perspective randomized trials on wider populations are needed to evaluate the advantage of BIPAP as respiratory support after extubation on the occurrence of bronchopulmonary dysplasia.

## ABS 43

## RISK FACTORS ASSOCIATED WITH CPAP FAILURE IN VERY LOW BIRTH WEIGHT INFANTS

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INTRODUCTION

CPAP failure is associated with unfavourable prognosis increasing the risk of pneumothorax, pulmonary interstitial emphysema, intraventricular haemorrhage (IVH), necrotising enterocolitis (NEC), bronchopulmonary dysplasia (BPD), and death. Currently it is not clear which interventions could improve CPAP effectiveness in the high-risk newborns. The aim of this study was to determine risk factors related to CPAP failure in very preterm infants to identify possible interventions for decreasing of CPAP failure risk.

METHODS

The prospective cohort included 151 outborn very preterm infants with respiratory distress syndrome (RDS), birth weight < 1,500 g, and gestational age < 32 weeks who were initially treated with CPAP. Infants who required intubation and mechanical ventilation within 120 h of initial CPAP attempt constituted the CPAP failure group (n = 46) while those, whose primary CPAP during that period was successful, were included into the success group (n = 105).

RESULTS

CPAP failure occurred at a median age of five hours in 30.5% of infants initially treated with CPAP and average (SD) $FiO_2$ at the failure point was 0.48 (0.15). The groups were not different in terms of birth weight but infants with CPAP failure had lower gestational age. Proportions of male and SGA infants, cesarean deliveries as well as prevalence of maternal infectious risk factors and preeclampsia were similar in the groups. A median (IQR) age of surfactant administration was 5 (3-6) hours in the failure group as compared to 4 (3-7) hours in the success group (p > 0.05). The risk of CPAP failure was significantly associated with surfactant treatment (aOR – 10.66; 95% CI: 2.99-38.06) and severe RDS (aOR – 8.26; 95% CI: 2.86-23.85) but was not influenced by antenatal steroid prophylaxis, gestational age, Apgar scores, additional use of non-invasive ventilation, and higher initial CPAP $FiO_2$.

CONCLUSIONS

Taking into account that infants in the CPAP failure group were treated with surfactant significantly more often than newborns in the CPAP success group, but the age of the first dose was not different between the groups, earlier use of surfactant could be the key intervention to prevent CPAP failure.

## ABS 44

## EFFECTS OF PASSIVE SMOKING ON LUNG FUNCTION TESTS IN PRESCHOOL CHILDREN BORN LATE-PRETERM

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INTRODUCTION

Late-preterm delivery is known to be associated with potential adverse effects on lung development and may result in alterations of pulmonary function. Since lung development is a programmed process, its interruption may be associated with decreased efficiency of lungs and increased susceptibility to environmental risk factors such as tobacco smoke. There is paucity of data on lung physiology in late-preterms with history of exposure to passive smoking, who may already have an increased risk of impaired lung function during childhood. This study aimed to evaluate the effect of passive smoking on lung function tests in preschool children born late-preterm, using impulse oscillometry (IOS).

METHODS

IOS is practical technique that is used to assess lung function. While patient is breathing normally, apparatus generates small pressure oscillations to determine impedance (Z) of the respiratory system. Pulmonary resistance (R) and reactance (X) are components of Z. R represents energy required to propagate pressure wave through airways. X is recoil generated against pressure wave. Lower frequencies are transmitted into peripheral lung. Higher frequencies provide information regarding central airways. Patients with congenital anomaly and respiratory tract infection were excluded. Any inhaled medications were stopped before study. Late-preterms with and without exposure to passive smoking (PS) were referred to as PS group and non-PS group, respectively. R and X were measured by IOS at 5-20 Hz.

RESULTS

The study population consisted of a total of 139 children between 3 and 7 years of age born late-preterm. There were 89 male and 50 female participants. Weight and height percentiles were within normal limits and the mean age was 67.4 ± 15.8 months. There was no difference between the perinatal characteristics of PS and non-PS group. Passive smoking history was present in 56.1%, n = 78 of late-preterms. Positive maternal smoking history was present 38.5% and 3.6% of PS and non-PS subjects, respectively ($p < 0.001$). Median R5-R20 and Z5 values of IOS were significantly higher and median X10 value of IOS was significantly lower in PS group compared to non-PS group ($p < 0.05$) (**Tab. 1**).

CONCLUSIONS

Our findings suggest the passive smoking is associated with a negative impact on IOS parameters in children born at late-preterm. In addition to the effects of late-premature birth, passive smoking is also likely to cause alterations in lung function of these children. These findings may facilitate efforts to limit exposure of at-risk children to passive smoking, which is already known to be a major health hazard.

## ABS 45

## THE EFFECT OF SUSTAINED LUNG INFLATION ON EARLY RESPIRATORY OUTCOMES IN TERM INFANTS

**Table 1 (ABS 44).** IOS parameters by passive smoking status in children born late-preterm.

| IOS | PS (n = 78) | | Non-PS (n = 61) | | p |
|---|---|---|---|---|---|
| | Median | 25th -75th percentiles | Median | 25th -75th percentiles | |
| **R5 kPa/(L/s)** | 0.95 | (0.81)-(1.19) | 0.84 | (0.75)-(1.00) | **0.007**[a] |
| **R10 kPa/(L/s)** | 0.81 | (0.72)-(1.02) | 0.72 | (0.64)-(0.82) | **0.003**[a] |
| **R15 kPa/(L/s)** | 0.73 | (0.64)-(0.94) | 0.66 | (0.61)-(0.82) | **0.009** [a] |
| **R20 kPa/(L/s)** | 0.69 | (0.60)-(0.87) | 0.61 | (0.54)-(0.76) | **0.007**[a] |
| **X5 kPa/(L/s)** | -0.27 | (-0.34)-(-0.21) | -0.24 | (-0.31)-(-0.20) | 0.18 |
| **X10 kPa/(L/s)** | -0.15 | (-0.21)-(-0.10) | -0.12 | (-0.20)-(-0.08) | **0.049**[a] |
| **X15 kPa/(L/s)** | -0.10 | (-0.15)-(-0.04) | -0.07 | (-0.15)-(-0.04) | 0.154 |
| **X20 kPa/(L/s)** | -0.01 | (-0.05)-(0.05) | 0.01 | (-0.05)-(0.05) | 0.325 |
| **Resfreq 1/s** | 20.57 | (17.78)-(22.28) | 19.33 | (17.53)-(22.29) | 0.25 |
| **Z5 kPa/(L/s)** | 1.00 | (0.85)-(1.20) | 0.90 | (0.78)-(1.03) | **0.007**[a] |

PS: passive smoking present; non-PS: passive smoking absent.
[a]Indicates significant difference between PS group and non-PS group.

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## INTRODUCTION

Sustained lung inflation has been recommended as a potential method for augmenting lung aeration at birth. Sustained inflation was suggested to reduce the need for intubation and ventilation in the first days of life. The aim of this study to evaluate the possible effect of sustained lung inflation in the delivery room on short-term respiratory outcomes in term infants.

## METHODS

Eighty term infants were randomly assigned to receive sustained inflation (30 $cmH_2O$ for 5 seconds) or no intervention in the delivery room. Sustained inflation was performed by using neonatal mask and T-piece ventilator. The primary outcome was the need for nasal continuous positive airway pressure (CPAP) and/or intubation for hospitalization in term infants. The secondary end points included the number of respirations, presence and/or development of respiratory distress findings, changes in the postnatal oxygen saturations, blood pressure, and need of supplemental oxygen in the first 2 hours of life in term infants. All these data were recorded.

## RESULTS

A total of 40 infants received sustained inflation in the delivery room whereas 40 infants enrolled into the control group. No significant differences were detected between 2 groups in terms of demographical data. Respiratory distress developed in significantly higher number of infants in the control group (75%) compared with sustained inflation group (25%) ($p = 0.05$). The infants in the control group had significantly higher $FiO_2$ requirement from the 10 minutes of life to 2 hours of life compared with sustained inflation group (all p 0.05).

## CONCLUSIONS

To our best of knowledge, this study showed for the first time that sustained inflation significantly decreased the respiratory distress development and $FiO_2$ requirement in the first 2 hours of life in term infants. It also reduced the CPAP and hospitalization rates. Therefore, sustained inflation should be used as an effective maneuver to improve short-term respiratory outcomes in term infants.

**ABS 46**

# $PCO_2$ LEVELS AND CLINICAL AND NEURO-DEVELOPMENTAL OUTCOMES OF EXTREMELY LOW BIRTH WEIGHT INFANTS

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## INTRODUCTION

Extreme levels or large fluctuations of $PCO_2$ may, according to retrospective studies, affect the outcome of extremely low birth weight infants. Randomised trials of different $PCO_2$ target ranges, however, did not demonstrate substantial differences of major outcome parameters but had considerable overlap between study groups owing to fluctuations of $PCO_2$ values. The recently completed PHELBI trial enrolled 359 preterm infants < 1,000 g birth weight and randomly allocated them to different $PCO_2$ targets. In an exploratory analysis, we hypothesized that actually achieved $PCO_2$ values in the trial may be related to major outcomes in extremely low birth weight infants.

## METHODS

For each infant, the minimal, maximal and time-weighted average of $PCO_2$ ($CO_2$ exposure) and the time-weighted average of the product of mean airway pressure (MAP) x the fraction of inspired oxygen ($FiO_2$) were determined. Infants were further subdivided into three groups on each treatment day: tendency towards hypercapnia, hypocapnia and, normocapnia. Overall assignment was determined by the group each infant spent the most days in. Two children with mainly fluctuating $PCO_2$ (infants whose maximal $PCO_2$ was in the upper quartile of maxima and minimal $PCO_2$ in the lowest quartile of minima on that day) were assigned to the group with the second most days. Statistical analyses were performed with ANOVA, Kruskal Wallis, $Chi^2$ and Fisher's exact tests as well as by multiple logistic regressions.

## RESULTS

Of all 359 infants, 230 were classified as normocapnic, 72 hypercapnic and 57 hypocapnic. Hypercapnic infants were slightly less mature, needed higher MAP * $FiO_2$ and more often had an open ductus arteriosus. They had a higher mortality and more frequently moderate or severe bronchopulmonary dysplasia (BPD) or necrotizing enterocolitis (NEC), and worse results for the mental development index (MDI). Their IVH incidence was not increased. Hypocapnic infants, however, had less IVH than the other groups (**Tab. 1**). Multiple logistic regression analyses revealed increased risks for moderate to severe BPD associated with birth weight ($p < 0.001$), $PCO_2$ exposition ($p < 0.01$) and MAP * $FiO_2$ ($p < 0.01$). The incidence of MDI < 70, was associated with birth weight ($p < 0.001$) and IVH ($p < 0.01$), and the incidence of the psychomotor development index (PDI) < 70 was strongly associated with IVH ($p < 0.001$) only.

## CONCLUSIONS

Hypercapnic infants received more, not less, mechanical ventilation, developed BPD and NEC more frequently and had a worse neurodevelopmental outcome. The differences seem stronger than what

**Table 1 (ABS 46).** Clinical characteristics in hypocapnic, normocapnic and hypercapnic infants.

| | All infants (n = 359) | Hypocapnic (n = 57, 16%) | Normocapnic (n = 230, 64%) | Hypercapnic (n = 72, 20%) | p |
|---|---|---|---|---|---|
| **Gestational age (weeks)** [a] | $25^{4/7} \pm 1^{2/7}$ | $25^{6/7} \pm 1^{3/7}$ | $25^{5/7} \pm 1^{2/7}$ | $25^{3/7} \pm 1^{2/7}$ | < 0.06 |
| **Birth weight (g)** [a] | 711 ± 154 | 690 ± 173 | 724 ± 147 | 685 ± 158 | 0.10 |
| **Average VTe** [b] | 3.39 ± 2.55 (204) | 3.06 ± 2.55 (25) | 3.27 ± 2.65 (129) | 3.86 ± 2.27 (50) | 0.21 |
| **Average $PCO_2$ exposition** [a] | 45 ± 13 | 36 ± 11 | 45 ± 10 | 50 ± 18 | < 0.01 |
| **Average MAP x $FiO_2$** [a] | 1.87 ± 0.94 | 1.41 ± 0.59 | 1.80 ± 0.83 | 2.47 ± 1.19 | < 0.01 |
| **Mortality until 36 weeks PMA** | 44 (12) | 7 (12) | 17 (7) | 20 (28) | < 0.01 |
| **Moderate/severe BPD** | 75 (21) | 10 (18) | 42 (18) | 23 (32) | |
| **Moderate/severe BPD or death** | 119 (33) | 17 (30) | 59 (26) | 43 (60) | |
| **IVH all grades** | 104 (29) | 10 (18) | 73 (32) | 21 (29) | < 0.01 |
| **Severe IVH (grade 3-4)** | 47 (13) | 7 (12) | 29 (13) | 11 (15) | 0.02 |
| **NEC ≥ 2** | 28 (8) | 6 (11) | 12 (5) | 10 (15) | 0.02 |
| **MDI** [c] | 82 (49-120, 249) | 86 (49-112, 39) | 84 (49-120, 168) | 63 (49-116, 42) | < 0.03 |
| **MDI < 70** | 78/249 (31) | 11/39 (28) | 45/168 (27) | 22/42 (52) | < 0.01 |
| **PDI** [c] | 84 (49-114, 226) | 88 (49-114, 33) | 84 (49-114, 154) | 81 (49-110, 39) | 0.18 |
| **PDI < 70** | 75/226 (33) | 9/33 (27) | 48/154 (31) | 18/39 (46) | 0.15 |

MAP: mean airway pressure; $FiO_2$: fraction of inspired oxygen; BPD: bronchopulmonary dysplasia; NEC: necrotizing enterocolitis; MDI: mental development index; PDI: psychomotor development index.
Unless otherwise specified, data is given as: number of infants (%), $\chi^2$ test.
[a]Mean ± SD, one way ANOVA; [b] mean ± SD, n Kruskal Wallis test; [c] median (min-max, n) Kruskal Wallis test.

would be expected from the small but significant difference in gestational age alone. However, hypercapnia seems to reflect higher disease severity, which might also contribute to the outcome differences.

## ABS 47

## AIR RETRIEVAL OF A NEWBORN BABY BORN WITH SEVERE CONGENITAL CARDIAC DEFECT

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### INTRODUCTION

The Newborn Emergency Transport Service of Western Australia (NETS WA) is a specialist team providing neonatal intensive care during intra facility transport. NETS WA retrieves more than 1,000 sick term and preterm infants from metropolitan and rural hospitals per year, throughout Western Australia for specialist care. Western Australia is the largest retrieval area in the world at over 2.5 million $km^2$.

### CASE REPORT

A prolonged air retrieval of an infant with total anomalous pulmonary venous return (TAPVR) from Darwin (Northern Territory, Australia) to Perth (Western Australia), a distance of over 2,500 km, is described. Following a normal delivery in Darwin, at the Northern most tip of Australia a newborn male infant developed respiratory distress, cyanosis and low oxygen saturations (40-60%) at 12 hours of life. He was transferred to the Neonatal Intensive Care Unit and CPAP was commenced. He required up to 100% oxygen. He was subsequently intubated ventilated requiring high mean airway pressure. An echocardiogram demonstrated total anomalous pulmonary venous return. There is currently no paediatric cardiac surgical or transport service in the Northern Territory of Australia and transfer of the infant, where definitive management would be undertaken. NETS WA was contacted at 19:00 hours, on 3rd March 2017, along with other transport teams from around Australia. The referral requested for a possible transfer to Princess Margaret Hospital for Children (PMH), Perth for emergency cardiac surgery. Following discussion with colleagues from around Australia, it was decided that NETS WA was able, in terms of recourses and location, to undertake the retrieval. A jet aircraft from a local medical retrieval service was chartered. Once the team was assembled and the aircraft prepared, the NETS WA team departed PMH at 04:40 hours on 4th March 2017. The flight to Darwin was expected to last 4 hours. During the time between referral and arrival of the team, the infant continued to have significant metabolic acidosis and intensive care demands. On arrival to the neonatal intensive unit at the Royal Darwin Hospital, the local and retrieval teams assembled for detailed multidisciplinary handover. The baby remained ventilated with high-pressure settings (mean airway pressure 14 $cmH_2O$ and, $FiO_2$ 1.0). He had umbilical lines *in situ* and saturations were 65-70%. As part of stabilisation he received sedation, paralysis, electrolyte correction, diuretics and multiple inotropes. It took considerable time (> 3 hours) to stabilise the baby for transfer. He had several episodes of hypotension and desaturation during attempted transfer from his bed to the transport incubator. This was a major challenge due to the number of medication pumps combined with the fragility of the infant's condition. The airport fire brigade was called to assist during the movement of the incubator onto the aircraft. The expected return flight was 4 hours. On the return flight the, the following difficulties arose:

1. recurrent hypotension – corrected by inotropic manipulation;
2. hypoglycaemia – corrected by 10% dextrose bolus and infusion of 20% dextrose;
3. depletion of oxygen cylinders;
4. intra transport monitoring (using blood gas measurement) and manipulation in flight.

The aircraft landed at a metropolitan regional airport approximately 40 minutes from the final destination (PMH). The retrieval and paediatric intensive care consultants were updated upon landing.

The baby was taken to theatre. Definitive cardiac surgery was undertaken within two hours of arrival. Despite some post-operative complications, he was discharged after one month to home. A prolonged air retrieval followed by an emergency cardiac surgery saved the life of the infant.

### CONCLUSIONS

This was an extremely challenging situation, which demonstrated excellent national collaboration, local/regional crew recourse management and teamwork. The number of teams involved was extensive and included the Royal Darwin NICU; Princess Margaret Hospital for Children PICU, NICU, NETS WA and cardiac services as well as local medical retrieval services (air and road). Crew

recourse management was difficult under such prolonged circumstances and regular sustenance, interchanging roles to allow for breaks, and uses of available recourses were necessary to allow for onward definitive care.

## ABS 48

## COMPARISON OF NIPPV AND NCPAP FOR THE MANAGEMENT OF RDS BY USING INSURE APPROACH IN PRETERM INFANTS

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### INTRODUCTION

Non-invasive ventilation starting from birth is an established practice in many centers. The aim of the present study is to compare the effects of two

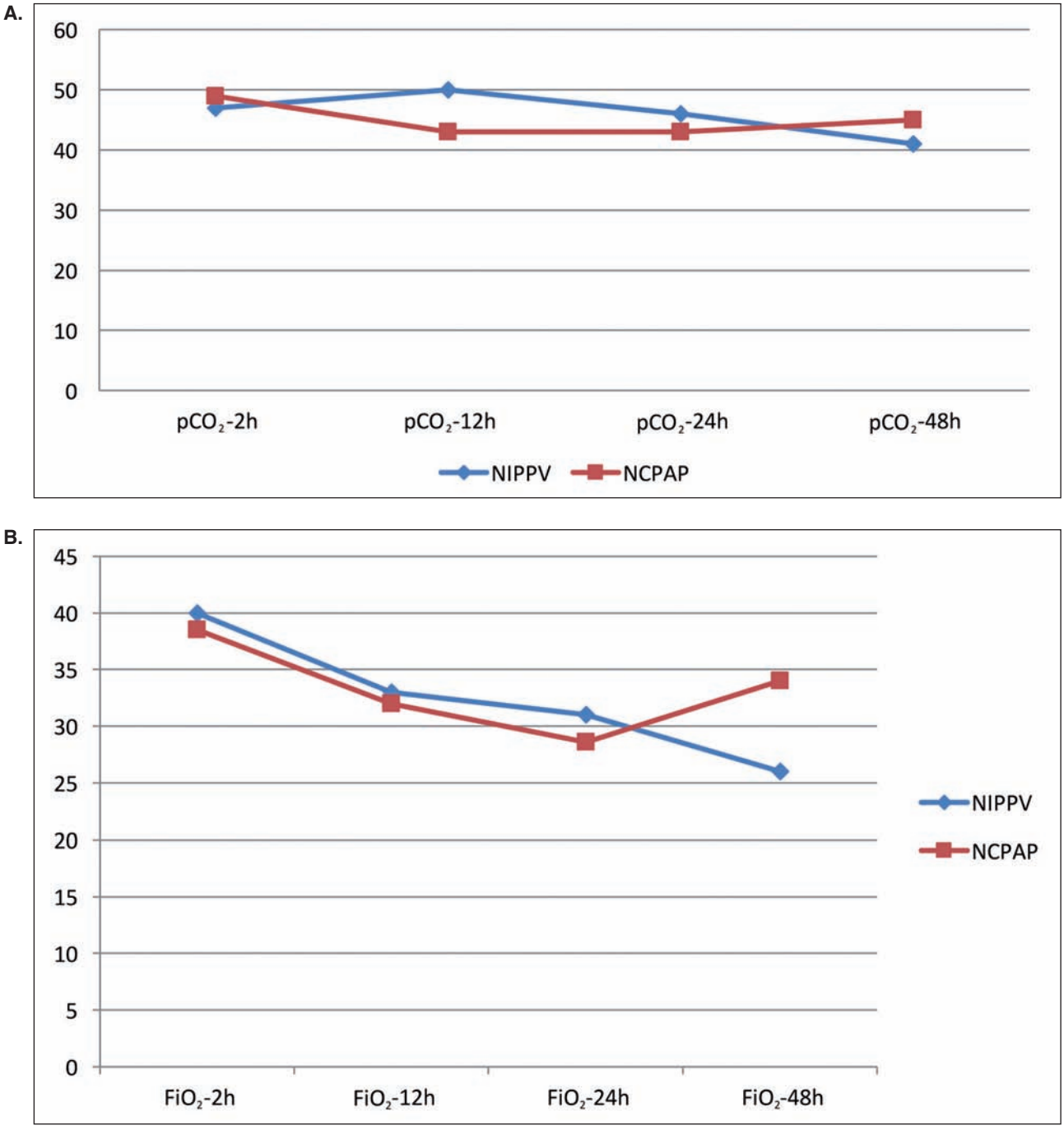


**Figure 1 (ABS 48).** Comparison of blood gas analysis (**A**) and $FiO_2$ (**B**) levels between NIPPV and NCPAP groups.

different noninvasive respiratory support methods, by using INSURE approach, on the long-term prognosis in preterm infants with RDS.

METHODS

Thirty-five infants < 32 weeks gestation and/or < 1,500 g birth weight who received early rescue surfactant treatment were enrolled. All infants were started on prophylactic caffeine within an hour after birth. NCPAP and NIPPV were both delivered by a neonatal ventilator via short, binasal prongs. NCPAP pressure was set at 6 $cmH_2O$, and NIPPV was set in a non-synchronised mode at 40 bpm, with PEEP of 6 $cmH_2O$ and PIP of 15-20 $cmH_2O$. $FiO_2$ was titrated at 0.21-0.50 to maintain $SpO_2$ level of 90-95%. 200 mg/kg of porcine surfactant was administered as a rescue therapy if the infant required ≥ 0.40 $FiO_2$ to maintain the target $SpO_2$ level of 90-95%. The primary outcome were reintubation within 72 hours, need for repetitive surfactant administration, and gastrointestinal intolerance. Both short and long term complications were compared including apnoea, pneumothorax, time for reaching total enteral feeding, IVH, BPD, ROP, PDA, NEC and mortality.

RESULTS

After administration of INSURE, infants were randomized to NIPPV (n = 15) and NCPAP (n = 20) groups. Need for re-intubation was 15% in NCPAP group vs 13.3% in NIPPV group. Gastrointestinal intolerance rates were 26% in NCPAP group vs 33% in NIPPV group ($p > 0.05$). When changes in $pCO_2$ and $FiO_2$ levels were compared between the groups, statistically lower $FiO_2$ levels were observed in the NIPPV group ($p < 0.05$) at postnatal 48 hour, but no significant difference could be demonstrated between the groups in terms of $pCO_2$ levels (**Fig. 1A** and **Fig. 1B**).

CONCLUSIONS

Duration of respiratory support and need for re-intubation is significantly lower in neonates receiving NIPPV. On the other hand, gastrointestinal intolerance rates are similar in infants receiving either NIPPV or NCPAP.

## ABS 49

## PERINATAL FACTORS ASSOCIATED TO THE FAILURE OF EARLY NASAL CONTINUOUS POSITIVE PRESSURE IN VERY LOW BIRTH WEIGHT INFANTS

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INTRODUCTION

The nasal continuous positive airway pressure (CPAP) is being used as the first ventilatory modality in premature infants because it is a less invasive technique and could minimize lung injury and related complications. However, some premature infants fail to adapt to early nasal CPAP. This study aims to evaluate the perinatal factors related with the failure of early nasal CPAP in VLBW infants.

METHODS

Prospective and observational study in which the VLBW infants admitted to the neonatal intensive care unit who received nasal CPAP as the first ventilatory modality were studied. This group was divided into those who failed and those who did not fail in noninvasive ventilation and they were compared considering maternal and neonatal characteristics. The means of the continuous variables were compared using the T-test or non-parametric tests. The frequencies were compared using the chi-square test with Fisher correction. A ROC-curve was used to evaluate the best cutoff point for transformation of continuous into categorical variables, and logistic regression was used to quantify their correlation with the failure of early nasal CPAP. The statistical package used was SPSS® 16.0 and the considered significance was < 0.05.

RESULTS

121 patients were evaluated. The group of preterm infants who failed in the use of early nasal CPAP (n = 26) presented with lower gestational age at birth and higher indices in clinical severity scores: presenting SNAPPE II ≥ 12 increases the probability of failure in early nasal CPAP by 7.5 times (95% CI: 2.37-23.62, p: 0.001). Birth weight and other perinatal variables were not different between the groups.

CONCLUSIONS

Preterm infants who failed in using early nasal CPAP presented lower gestational age and higher rates of SNAPPE II score.

## ABS 50

## VENTFIRST: A MULTICENTER RCT OF ASSISTED VENTILATION DURING DELAYED CORD CLAMPING FOR EXTREMELY PRETERM INFANTS

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## INTRODUCTION

Establishing lung inflation prior to umbilical cord clamping may stabilize cardiovascular transition and reduce the risk of intraventricular hemorrhage in preterm infants. A pilot feasibility and safety study of infants < 33 weeks gestation demonstrated that assisting ventilation of very preterm infants during 90 seconds of delayed cord clamping (DCC) is challenging but feasible and appears safe [1]. A large randomized clinical trial (RCT) is currently underway to determine clinical benefit.

## METHODS

Infants between $23^{0/7}$ and $28^{6/7}$ weeks gestation are eligible, with exclusion criteria of monochorionic/amniotic twins, higher multiples, emergency delivery or provider concern, and life-threatening condition of fetus/comfort care. The primary outcome is intraventricular hemorrhage (IVH any grade) on head ultrasound 7-10 days after birth. The study hypotheses are that infants not breathing well by 30 seconds from birth are less likely to have IVH if they receive assisted ventilation from 30-120 seconds followed by cord clamping (VentFirst arm), compared to those with cord clamping at 30-60 seconds followed by assisted ventilation (standard arm) and that infants breathing well by 30 seconds from birth will also be less likely to have IVH in the VentFirst as compared to standard arm.

## RESULTS

With funding from the Eunice Kennedy Shriver National Institute for Child Health and Human Development, the RCT is being conducted at 6 centers in the United States and 2 in Canada. Enrollment is underway with the goal of including 940 infants in 5 years. Consented mothers frequently go on to deliver beyond 29 weeks, when no longer eligible for study procedures. Participating centers use a variety of equipment configurations for the resuscitation surface, including a specially designed trolley, customized movable table, and adapted backboard. Equipment to provide ventilation includes a t-piece resuscitator, oxygen blender and flowmeter, air and oxygen tanks, and end-tidal $CO_2$ detector. Immediate post-delivery interventions, hematologic and cardiopulmonary parameters in the first 24 hours and 10 days, as well as complications of prematurity are being collected as secondary outcomes.

## CONCLUSIONS

Data from this large RCT will address the potential benefit of establishing ventilation before umbilical cord clamping in a population of infants who have previously been excluded from many trials of delayed cord clamping, but who may stand to benefit the most from physiologic clamping of the cord.

## REFERENCE

[1] Winter J, Kattwinkel J, Chisholm C, Blackman A, Wilson S, Fairchild K. Ventilation of Preterm Infants during Delayed Cord Clamping (VentFirst): A Pilot Study of Feasibility and Safety. Am J Perinatol. 2017;34(2):111-6.

## ABS 51

# IS THE DOUBLE LUNG POINT AN ACCURATE DIAGNOSTIC MARKER FOR TRANSIENT TACHYPNEA OF THE NEONATE? A PROSPECTIVE, INTERNATIONAL STUDY

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## INTRODUCTION

Transient tachypnea of the neonate (TTN) is a frequent cause of respiratory distress, particularly among late preterm neonates. TTN is commonly diagnosed ruling out other diseases on a clinical ground. Using lung ultrasound (LUS), previous monocentric studies have produced conflicting evidences on the Double Lung Point (DLP) as the only pathognomonic marker of TTN. The DLP consists of more hyperechoic lower lung fields (**Fig. 1**). We conducted the first prospective, international

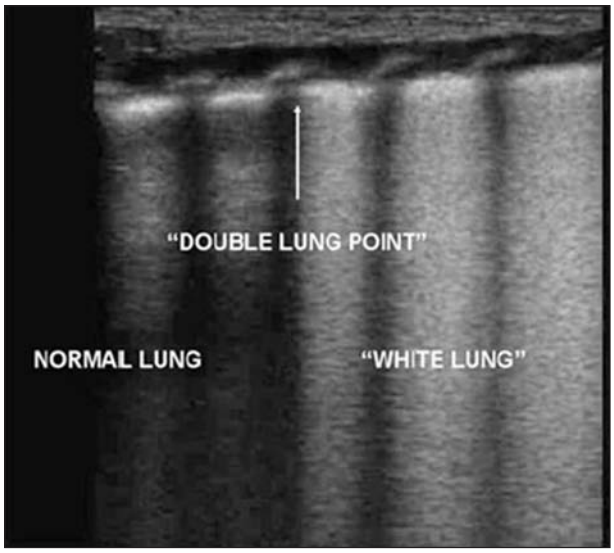


**Figure 1 (ABS 51).** The Double Lung Point (DLP) consists of more hyperechoic lower lung fields.

investigation on the accuracy of the DLP in ruling in TTN.

METHODS

We enrolled neonates with a gestational age 34-40 weeks in clinical respiratory distress as assessed by a physician masked to the study purpose. We excluded neonates with: a gestational age less than 34 weeks; clinical and radiological criteria suggestive of classical hyaline membrane disease, early-onset sepsis or pneumonia; major malformations. The first LUS scan was acquired at 60-180 minutes of life and sequential scans every 2-5 hours if still in distress while on spontaneous respiration with/without supplemental oxygen or monitored with a minimal interval of 8-12 hours if on CPAP /MV ventilation. Scans were graded using a previously validated LUS score. Relevant clinical information was collected as long as the patient remained in respiratory distress for correlation with LUS data.

RESULTS

We enrolled 48 patients (BW = 2,494 ± 175; GA = 36 ± 1.5). The DLP was present in 23/48 cases within the first 24 hours. No DLP was shown by 21/48 infants. Late (> 24 hours) DLP appearance was demonstrated in four neonates. Comparing DLP+ and DLP- patients, no significant difference was found in Silverman score > 7 (8.3% vs 19%); LUS score > 8 (43% vs 42%); $FiO_2/PaO_2 < 70$ (0% vs 0%); non invasive respiratory support (82% vs 95%). When appearing late, DLP was always absent while the infant was still on respiratory support.

CONCLUSIONS

In our multicenter population, the DLP had a poor sensitivity to rule in TTN. Preliminary data fail to associate the presence of DLP with a more or less severe clinical course of respiratory distress.

## ABS 52

## BEDSIDE LUNG ULTRASONOGRAPHY FOR THE DIAGNOSIS OF NEONATAL RESPIRATORY DISTRESS IN THE FIRST 24 HOURS OF LIFE

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INTRODUCTION

Respiratory distress (RD) is the most common neonatal illness. Due to similar clinical presentations of diseases, the differential diagnosis is often difficult especially in the first 24 hours of life. Standard management includes evaluation of chest X-rays (CXR). Bedside lung ultrasound (LUS) is used as a screening tool in a variety of medical conditions. Studies on LUS in infants have a main limitation; patients were enrolled by a single skilled operator, so these results cannot be generalized. Our aim was to determine concordance of LUS used by a group of clinicians with different training level compared with CXR for the diagnosis of RD in newborns during the first 24 hours of life.

METHODS

We enrolled patients with RD during the first 24 hours of life that performed a CXR. Operators were blinded to any prenatal diagnosis. LUS was performed scanning anterior, lateral and posterior chest walls. Diaphragm was investigated by a sub-costal view. All sonologists, except for two, were novices to LUS and attended a 2-hours didactic session followed by a 30-minute practical session. Before starting the enrollment, novice sonologists had to perform 25 supervised LUS examinations. LUS and CXR diagnosis were compared to evaluate concordance. 20% of enrolled patients received two LUS (one experienced and one

novice sonographer) to calculate the inter-rater agreement. Differences in time needed to reach a diagnosis with LUS and CXR and from novice and experienced operators were studied.

RESULTS

124 infants were enrolled (134 diagnosis). The overall concordance between LUS and CXR diagnosis was 91% (CI 95% 86-96%) with k = 0.88 (CI 95% 0.81-0.94). **Tab. 1** summarized LUS and CXR diagnosis. Disagreement were due to 5 pleural effusion and 1 congenital cystic adenomatoid lesion detected at LUS while the CXR was negative, 2 pneumothorax missed at LUS, and 4 discordant RD syndrome – Transient Tachypnea diagnosis. The median time to diagnosis was shorter ($p < 0.0001$) for LUS (9.5 min, IQR 5-15) than CXR (50 min, IQR 33-64). In 25 patients LUS was performed by both novice and senior sonologists. Twenty-nine diagnoses were made with a complete concordance between operators and between LUS and CXR. The median time to diagnosis was shorter ($p < 0.0002$) for senior (9 min, IQR 5-15) than novice operator (15 min, IQR 10-20).

CONCLUSIONS

LUS in our study setting has a good concordance compared with CXR in the diagnosis of RD in newborns in the first 24 hours of life. We demonstrated that LUS reached diagnosis in less time than CXR. The learning curve is fast and rapidly reaches a very good concordance between experienced and novice operator. LUS is not thought to completely replace CXR in RD of newborns but it might be considered an additional tool in the NICU.

## ABS 53

## IMPACT OF THE USE OF HIGH POSITIVE END EXPIRATORY PRESSURE ON EXTUBATION OF PREMATURE INFANTS WITH SEVERE BRONCHOPULMONARY DYSPLASIA

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INTRODUCTION

The use of mechanical ventilation in preterm infants for prolonged periods has been associated with higher morbidity and mortality and extubation has been recommended as early as possible. Benefits have been attributed to the use of continuous airway distension pressure after extubation such as better oxygenation rates and improved respiratory mechanics. However there are doubts about the safety of using high positive end expiratory pressure (HPEEP) in extubation of preterm infants. The objective of this study was to verify the association of morbidities with the use of HPEEP in the extubation of premature infants with severe bronchopulmonary dysplasia.

METHODS

This is a cohort and retrospective study, which will include newborn included in the Brazilian Neonatal Network with birth weight below 1,500 grams, born between January 2013 and December 2016, with severe bronchopulmonary dysplasia, in one university hospital. The study was approved

**Table 1 (ABS 52).** Comparison between lung ultrasound (LUS) and chest X-ray (CXR) diagnosis.

| | | CXR | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RDS | TTN | Pneumonia | MAS | CDH | Pleural effusion | PNX | CCAM | Negative | Total |
| LUS | RDS | 58 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 60 |
| | TTN | 2 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 |
| | Pneumonia | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| | MAS | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 6 |
| | CDH | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| | Pleural effusion | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 5 | 7 |
| | PNX | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 8 |
| | CCAM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 3 |
| | Negative | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 3 | 5 |
| | Total | 60 | 32 | 6 | 6 | 7 | 2 | 10 | 2 | 9 | 134 |

LUS: lung ultrasound; CXR: chest X-ray; RDS: respiratory distress syndrome; TTN: transient tachypnea of the newborn; MAS: meconium aspiration syndrome; CDH: congenital diaphragmatic hernia; PNX: pneumothorax; CCAM: congenital adenomatoid cystic malformation.

by the Research Ethic Committee under process number 1,018,827. The analyses were made using SAS 9.3 software. All newborns who died prior to extubation, those with major malformations and/or genetic syndrome, and those with upper airway problems were excluded. Two study groups were set up. The first group consisted of patients who Low PEEP (LPEEP), between 5 and 6 cm of water in the nasal CPAP, and the second group of patients using HPEEP between 7 and 15 cm of water. The means with their respective standard deviations of the gestational weights and ages at birth, SNAPPE-II and time of mechanical ventilation of the children included in the study were calculated, and Student's t-test was performed for the comparative analysis of these characteristics between the two groups. Fisher's exact test was performed to verify the association of pneumothorax and death with different levels of PEEP. Bronchopulmonary dysplasia was defined as the need for oxygen in concentrations above 21% until corrected postnatal age > 36 weeks, being considered as having severe bronchopulmonary dysplasia in children with a need for an inspired fraction of oxygen > 30% or pressure positive at 36 weeks corrected postnatal age.

RESULTS

A total of 92 children were included. Of these, 6 patients were excluded: 1 due to death prior to extubation, 3 due to severe malformations and/or genetic syndrome and 2 due to upper airway problems. 86 children completed the study. The group that used LPEEP consisted of 48 patients and the group that used HPEEP, of 38 children. The children in the group with LPEEP presented mean gestational age and birth weight higher than those in the HPEEP group (28 weeks [SD = 12.61 days] vs 27 weeks [SD = 15.24 days], respectively, p-value < 0.01). Moreover, they presented lower severity scores at neonatal intensive care unit admission (SNAPPE-II 31.69 [SD = 25.12] vs 42.29 [SD = 20.94], p-value = 0.04), and remained for shorter periods on mechanical ventilation [45.51 days respectively (SD = 41.15 days) vs. 68.26 days (SD = 39.87 days), p-value < 0.01 (**Tab. 1**). There was no significant difference between the groups regarding the sex of the children included in the study (p-value = 0.06). The mean corrected gestational age of extubation of the children in the LPEEP group was 34 weeks and of the group with HPEEP 36 weeks. There was no difference between groups in the proportion of pneumothorax and death. No pneumothorax was associated with HPEEP since all of them occurred prior to extubation and no death was attributed primarily to HPEEP since the meantime death time was 96 days after extubation. Only one child in the HPEEP group died two days after extubation due to late sepsis.

CONCLUSIONS

The use of high PEEP (7-15 cm of water) in the extubation of premature infants with severe bronchopulmonary dysplasia is viable and in our experience did not cause additional morbidities such as pneumothorax and death. Further studies are needed to confirm its benefits.

## ABS 54

## THE USE OF DEXAMETHASONE IN PRETERM INFANTS FOR LUNG DISEASE IN A TERTIARY NICU

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INTRODUCTION

Bronchopulmonary Dysplasia (BPD) is a recognised cause for prolonged hospitalisation, poor growth and adverse neurodevelopment outcome in preterm infants. Postnatal steroids may decrease prolonged ventilation, one of the risk factors for BPD. However, there are concerns about the adverse effects of steroids. The aim of the study was to assess the use, safety and efficacy of dexamethasone in preterm infants with lung disease.

METHODS

The study was a retrospective analysis over 5 years (Jan 2010-Dec 2015) in preterm infants born at less than 32 weeks gestation receiving dexamethasone in a tertiary neonatal intensive care unit. A total of

**Table 1 (ABS 53).** Association between high positive end expiratory pressure (HPEEP) and death and pneumothorax.

| | Death | | | Pneumothorax | | |
|---|---|---|---|---|---|---|
| | No, n (%) | Yes, n (%) | p-value [a] | No, n (%) | Yes, n (%) | p-value [a] |
| LPEEP [b] | 44 (91.67) | 4 (8.33) | 0.50 | 45 (93.75) | 3 (6.25) | 0.69 |
| HPEEP [c] | 33 (86.84) | 5 (13.16) | | 34 (89.47) | 4 (10.53) | |

[a] Fisher Exact Test; [b] LPEEP: Low PEEP (5- 6 cm water); [c] HPEEP: High PEEP (7-15 cm water).

69 babies were included in this study. The DART dexamethasone regimen was used (150 mcg/kg 12 hourly for days 1-3, 100 mcg/kg 12 hourly for days 4-6, 50 mcg/kg 12 hourly for days 7-9 and stop). Demographic data along with data on adverse effects related to dexamethasone was collected from BadgerNet and scanned patient records where available.

RESULTS

Six percent (69/1,138) of preterm infants received dexamethasone on NICU during study period. The mean gestation was $25^{+1}$ weeks ($23^{+1}$ to $31^{+4}$) and mean birth weight of 727 g (510 g to 1,660 g). Reason to give dexamethasone is in 70% to facilitate extubation, 12% due to difficult ventilation and in 18% due to very high oxygen requirement on non-invasive respiratory support. 46% had more than one failed extubation; mean age of start of dexamethasone is 26 days (12 to 61 days). Mean duration of dexamethasone used is 9 days. 40% had shortened course. 70% had either medical or surgical intervention for Patent Ductus Arteriosus (PDA). 44% needed re-intubation after dexamethasone. Adverse events related to dexamethasone treatment included hypertension (8%), hyperglycaemia (10.5%), ventricular hypertrophy (3%). 85% needed treatment (medical, surgical or both) for PDA. 66.7% were discharged on home oxygen.

CONCLUSIONS

A small number (6%) of our infants born before 32 weeks gestation required dexamethasone for lung disease of prematurity. Nearly half of these infants had had a failed trial of extubation prior to dexamethasone. However, nearly half of the infants still needed re-intubation. Amongst these infants a large number went home on home oxygen.

## ABS 55

## CONSULTANT PRESENCE AT DELIVERY: A RETROSPECTIVE AUDIT OF DEMOGRAPHICS AND OUTCOMES IN A TERTIARY UK CENTRE

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INTRODUCTION

There is increasing acknowledgement that respiratory management at birth will influence the development of lung pathology. We have previously reported on the impact of the timing of birth (day or night) and the risk of respiratory illness in preterm neonates. In this study we explored the difference in demographics and respiratory outcomes of infants related to the presence of a Consultant (Senior Clinician) at birth. Aim: To compare demographics and respiratory outcomes of infants born with a Consultant present at delivery vs without a Consultant present at delivery.

METHODS

Retrospective observational study of surviving preterm infants < 30 weeks of gestational age (GA) born in a single tertiary centre between 2006 and 2014. Patients with congenital anomalies were excluded. Data were gained from discharge summaries or the neonatal unit patient electronic record system. Patients included were grouped according to whether a consultant was present at the delivery or not. Demographic and outcome measures of included infants were compared. Qualitative data were analyzed using Chi-Square and quantitative data using Mann-Whitney test. $P < 0.05$ was considered significant. Data are displayed as median and $25^{th}$-$75^{th}$ quartile range (IQR) or ratio (n/N) and percentage (%).

RESULTS

Infants who had consultant presence at delivery were of significantly lower GA and birth weight. There were also more males in this group, more multiples, who were more likely to be born during the day via c-section. Infants born with a consultant present at delivery were more likely to have surfactant delivered earlier, be ventilated (mechanically or non-invasively) longer, develop BPD and receive postnatal steroids. No differences in other clinical outcomes were noted (**Tab. 1**).

CONCLUSIONS

The difference between the GA and birth weights of the two groups it is unsurprising that such differences are seen in respiratory outcomes. The fact that Neonatal Consultant presence is higher for the younger and smaller infants, delivered by C-sections, indicates that these births were perhaps planned. When Consultants were not present, it was more likely to be at night pointing towards the more emergent or unanticipated nature of the birth.

**Table 1 (ABS 55).** Demographics & antenatal factors of newborns in the 2 groups: Neonatal Consultant present and not present in the delivery room.

| | | Consultant present at delivery (n = 298) | Consultant not present at delivery (n= 203) | p-value |
|---|---|---|---|---|
| **Demographics & antenatal factors** | | | | |
| **Gestational age (weeks)** | | 26 (25-28) | 28 (26-29) | < 0.0001 |
| **Birthweight (grams)** | | 860 (687-1,080) | 1,090 (830-1,290) | < 0.0001 |
| **Gender n (%)** | **Male** | 157 (53) | 130 (64) | 0.01 |
| | **Female** | 141 (47) | 73 (36) | |
| **Maternal age (years)** | | 31 (25-26) | 30 (24-35) | 0.35 |
| **Multiplicity n (%)** | **Singleton** | 182 (61) | 169 (83) | < 0.0001 |
| | **Twins** | 90 (30) | 32 (16) | |
| | **Triplets** | 26 (9) | 2 (1) | |
| **Delivery method n (%)** | **Vaginal** | 96 (32) | 96 (47) | 0.0007 |
| | **C-Section** | 202 (68) | 107 (53) | |
| **Antenatal steroids n (%)** | **Yes** | 276 (93) | 183 (90) | 0.96 |
| | **No** | 18 (6) | 13 (6) | |
| | **Unknown** | 4 (1) | 7 (4) | |
| **PROM n (%)** | **Yes** | 96 (32) | 72 (35) | 0.29 |
| | **No** | 197 (66) | 124 (61) | |
| | **Unknown** | 5 (2) | 7 (4) | |
| **5 min APGAR** | | 8 (6-9) | 8 (7-9) | 0.04 |
| **Time of delivery n (%)** | **Day** | 197 (67) | 83 (41) | < 0.0001 |
| | **Night** | 101 (33) | 120 (59) | |
| **Respiratory outcomes** | | | | |
| **Surfactant delivery** | **None** | 48 (16) | 60 (29) | 0.0002 |
| | **Within 1 hour** | 225 (75) | 114 (56) | |
| | **Between 2-4** | 8 (2) | 4 (2) | |
| | **After 4 hours** | 18 (6) | 24 (12) | |
| | **Unknown** | 1 (1) | 1 (1) | |
| **Length of 1st mechanical ventilation episode (days)** | | 1 (1-5) | 1 (0-3) | 0.0007 |
| **Total time of mechanical ventilation (days)** | | 6 (1-23) | 2 (0-8) | < 0.0001 |
| **Total time of non-invasive ventilation (days)** | | 50 (12-80) | 22 (7-53) | < 0.0001 |
| **BPD n (%)** | **Yes** | 148 (49) | 60 (30) | < 0.0001 |
| | **No** | 50 (51) | 143 (70) | |
| **Postnatal steroids n (%)** | **Yes** | 56 (19) | 13 (6) | < 0.0001 |
| | **No** | 242 (81) | 190 (94) | |
| **Clinical outcomes** | | | | |
| **NEC (surgical intervention) n (%)** | **Yes** | 23 (8) | 17 (8) | 0.79 |
| | **No** | 275 (92) | 186 (92) | |
| **IVH n (%)** | **≤ Grade 2** | 269 (90) | 175 (86) | 0.35 |
| | **≥ Grade 3 or cystic PVL** | 25 (8) | 25 (12) | |
| | **Unknown** | 4 (2) | 3 (2) | |
| **ROP n (%)** | **≤ Grade 2** | 288 (97) | 109 (97) | 0.56 |
| | **≥ Grade 3** | 10 (3) | 5 (3) | |
| **Death n (%)** | **Yes** | 244 (82) | 178 (88) | 0.08 |
| | **No** | 54 (18) | 25 (12) | |

**ABS 56**

## THE COMPARISON OF HEATED HUMIDIFIED HIGH-FLOW NASAL CANNULA VERSUS NASAL CONTINUOUS POSITIVE AIRWAY PRESSURE FOR RESPIRATORY SUPPORT IN NICU

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### INTRODUCTION

Respiratory distress syndrome (RDS) is one of the most common respiratory problems to be encountered in the neonatal intensive care unit (NICU). Recently, heated humidified high-flow nasal cannula (HHHFNC) have been introduced and applied in infants with less nasal trauma than nasal continuous positive airway pressure (NCPAP) and non-invasive positive pressure ventilation (NIPPV). Several studies have indicated that HHHFNC may be as effective as NCPAP and NIPPV. The aim of this study is to compare the requirement for NIPPV between HHHFNC and NCPAP for preterm infants for the primary treatment of RDS.

### METHODS

This is a single-center, prospective, randomized case-control trial in the NICU. Preterm infants with RDS were eligible for the study if they were born at less than 37 weeks gestation and birth weight more than 1,500 g. Preterm infants enrolled in the study were randomly assigned to HHHFNC or NCPAP group, and those who required NIPPV for primary treatment were excluded. The primary outcome was

**Table 1 (ABS 56).** Characteristic and respiratory outcomes of the 2 groups.

| | HHHFNC (n = 14) | NCPAP (n = 29) | p-value |
|---|---|---|---|
| **Characteristic** | | | |
| **Mothers** | | | |
| **Age, years, mean ± SD** | 30.7 ± 6.6 | 35 ± 2.9 | 0.035 [a] |
| **Antenatal steroids, n (%)** | 5 (36%) | 7 (20%) | 0.428 [b] |
| **Cesarean section, n (%)** | 9 (64%) | 24 (80%) | 0.452 [b] |
| **Infants** | | | |
| **Male sex, n (%)** | 8 (57%) | 12 (40%) | 0.449 [b] |
| **Gestational age, weeks, mean ± SD** | 34.9 ± 0.9 | 35 ± 1.2 | 0.677 [a] |
| **Birth weight, g, mean ± SD** | 2,245 ± 342 | 2,109 ± 319 | 0.208 [a] |
| **Apgar score at 1-min, median (IQR 25%-75%)** | 8 (8-8) | 8 (8-9) | 0.562 [c] |
| **Apgar score at 5-min, median (IQR 25%-75%)** | 9 (9-9) | 9 (8-9) | 0.713 [c] |
| **Multiple births, n (%)** | 6 (43%) | 18 (62%) | 0.235 [b] |
| **Surfactant treatment before enrolled, n (%)** | 1 (7%) | 0 (0%) | 0.145 [b] |
| **Respiratory outcomes** | | | |
| **NIPPV ventilation, n (%)** | 5 (36%) | 17 (59%) | 0.159 [b] |
| **ETT ventilation, n (%)** | 0 (0%) | 1 (3%) | 0.482 [b] |
| **Days of HHHFNC, day, median (IQR 25%-75%)** | 6 (9-9) | 9 (8-11) | 0.202 [c] |
| **Days of NCPAP, day, median (IQR 25%-75%)** | 5 (2-8) | 5 (3-14) | 0.661 [c] |
| **Days of NIPPV, day, median (IQR 25%-75%)** | 1 (1-1) | 1 (1-2) | 0.101 [c] |
| **Days of ICU, day, median (IQR 25%-75%)** | 5 (3-11) | 7 (3-17) | 0.639 [c] |
| **Days of hospital, day, median (IQR 25%-75%)** | 20 (13-22) | 21 (13-25) | 0.273 [c] |

HHHFNC: heated humidified high-flow nasal cannula; NCPAP: nasal continuous positive airway pressure; NIPPV: non-invasive positive pressure ventilation.
[a] t-Test; [b] Chi-square; [c] Mann-Whitney rank sum-test on medians.

defined as need of NIPPV support. Once infant was failed, HHHFNC and NCPAP could be used for weaning from NIPPV.

RESULTS

A total of 43 RDS preterm infants were enrolled to this study and randomized to receive either HHHFNC group (n = 14) or NCPAP group (n = 29). The characteristics of infants were comparable for the HHHFNC and NCPAP groups. There were no difference between HHHFNC group and NCPAP group in failure for primary respiratory support (36% vs. 59%, p = 0.159), days of HHHFNC use (6 vs. 9, p = 0.202), days of NCPAP use (5 vs. 5, p = 0.661), days of NIMV use (1 vs. 1, p = 0.101), days of ICU stay (5 vs. 7, p = 0.639) and days of hospital stay (20 vs. 21, p = 0.273). No nasal traumas were noted in both groups. Results are presented in **Tab. 1**.

CONCLUSIONS

Based on our study, HHHFNC appears to have similar efficacy to NCPAP in primary treatment of preterm infants with RDS. HHHFNC provides respiratory support with higher comfort and less irritation compared to NCPAP. Infants with RDS who required respiratory support may use HHHFNC instead of use NCPAP.

## ABS 57

## COMPARISON BETWEEN OUTCOMES OF MINIMALLY INVASIVE TECHNIQUE AND INTUBATION SURFACTANT EXTUBATION IN PRETERM INFANTS LESS THAN 1,500 GRAMS IN A DEVELOPING COUNTRY

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INTRODUCTION

The lungs of premature infants are most susceptible to ventilation-induced injury, so better ways to administer surfactant are being investigated. The administration of minimally invasive surfactant therapy (MIST) has demonstrated shorter duration of oxygen therapy, reduction of the incidence of bronchopulmonary dysplasia and complications associated with prolonged mechanical ventilation. Anther important aspect in the MIST evaluation is the viability and cost-benefit of its implementation in developing countries.

METHODS

A retrospective cohort of 20 very low birth weight with respiratory distress syndrome (RDS), born in the years 2015 and 2016 was analyzed. Newborn admitted in nasal continuous positive airway pressure who received surfactant using modified MIST with orogastric tube for tracheal catheterization was compared with newborn that evolved with need of orotracheal intubation and received surfactant with intubate, surfactant, extubate (InSurE) technique. The need for orotracheal intubation with less than 24 hours was considered as failure of the MIST. The surfactant administrated was poractant alfa or beractant. Several outcomes were compared using Fisher's exact test.

RESULTS

A total of 9 patients received InSurE and 11 patients received MIST in the period. In the group receiving InSurE the mean gestational age was 28 weeks and 6 days; birth weight was 1,065 ± 237 grams, 51 days of hospitalization, the SNAPPE II score was 32, oxygen therapy time was 24 days and received mechanical ventilation for 15 days. The group that received MIST had a mean gestational age of 27 weeks and 2 days, birth weight of 888 ± 210 grams, remained 63 days in the hospital, the SNAPPE II score was 29, oxygen therapy time was 38 days and mean mechanical ventilation was 27 days. There was no statistical difference between the groups. Need for orotracheal intubation within 24 hours occurred in 9 patients of the InSurE group and only in 2 patients who received MIST (p 0.05). There

**Table 1 (ABS 57).** Summary of outcomes according to surfactant therapy technique.

| Outcomes | InSurE | MIST | p-value |
|---|---|---|---|
| Retreatment need | 3 | 5 | 1.00 |
| Death | 1 | 4 | 0.59 |
| Air leak syndrome | 1 | 1 | 1.00 |
| Pulmonary hemorrhage | 4 | 1 | 0.13 |
| HFV | 5 | 4 | 0.65 |
| Oxygen > 36 weeks PMA | 1 | 3 | 1.00 |
| PIVH grade ≥ 3 | 2 | 0 | 0.03 |
| Seizures | 5 | 1 | 0.07 |
| Use of vasopressors and inotropes | 5 | 2 | 0.16 |
| ROP stage ≥ III | 2 | 1 | 0.58 |
| NEC | 1 | 3 | 0.59 |
| Antibiotics use | 5 | 9 | 0.33 |

InSurE: intubate, surfactant, extubate technique; MIST: minimally invasive surfactant therapy; HFV: high frequency ventilation; PMA: postmenstrual age; PIVH: peri-intraventricular hemorrhage; ROP: retinopathy of prematurity; NEC: necrotizing enterocolitis.

was more grade 3 and 4 intracranial haemorrhage in the InSurE group (p 0.03). The results are presented in **Tab. 1**.

CONCLUSIONS

The administration of MIST, despite the modified technique for our reality, presented evidence of less need for orotracheal intubation in the subsequent 24 hours and less evolution for, peri-intraventricular hemorrhage (PIVH) grade 3 and 4. The worst neurological outcome in InSurE group may be associated to intubation act and/or ventilation in the first hours of life. A larger sample is necessary, mainly to evaluate respiratory outcomes.

## ABS 58

## PREMATURE INFANTS WITH VERY LOW WEIGHT WITH APNEA HAVE POOR RESULTS DESPITE TREATMENT

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INTRODUCTION

Despite the improvement in neonatal care, with new therapies and oxygenation targets, apnea continues to be a recurring problem in the Neonatal Intensive Care Unit (NICU). The treatment in recent years has become an important tool for the management of apnea in ours NICU, and improved our care. The outcome of the patients with recurrent apnea is still a challenge.

METHODS

A retrospective cohort study with 694 eligible VLBW infants, born in our hospital from 2006 to 2015. Patients who had apnea and received treatment with intravenous aminophylline or oral caffeine are 284 infants. The following parameters were compared: the use of prenatal CE, retinopathy of prematurity (ROP), patent ductus arteriosus (PDA), SNAPPE-II Score, peri-intraventricular haemorrhage (PIVH), bronchopulmonary dysplasia (BPD), enterocolitis, shock in first 72 hours and death. Patients with congenital malformations, congenital infections and death on the first day of life were not included. Method: Simple log-binomial regression model (RRbruto) and multiples (RRaj: adjusted by birth weight and SNAPPE-II Score). Software: SAS 9.3.

**Table 1 (ABS 58).** Outcome according to the presence of recurrent apnea.

| Outcomes | Apnea n = 284 | No apnea n = 410 | RRaj (IC95%) |
|---|---|---|---|
| BPD | 24.1% | 14.6% | 1.77 (1.25; 2.50) |
| ROP stage ≥ III | 24.2% | 12.7% | 1.77 (1.05; 2.99) |
| PDA | 48.2% | 31.8% | 1.67 (1.38; 2.03) |

RRaj: RR adjusted; BPD: bronchopulmonary dysplasia; ROP: retinopathy of prematurity.

RESULTS

Two groups: Group No apnea: 59.1% of our cohort were patients with no apnoea, with mean weight 924.3 g, mean gestational age 28 w 2 d, 35.5 days in NICU; Group Apnea: patients with recurrent apnoea were 40.9%, mean weight 1,030.9 g, mean gestational age 28 w 6 d, 35.8 days at NICU. There was no difference between weight and gestational age between groups. There was no statistical difference between the groups at others variables. There was an association between apnea and BPD, ROP and PDA (**Tab. 1**).

CONCLUSIONS

Apnea of prematurity in preterm infants with less than 1,500 g, even with treatment, is associated with the development of BPD, ROP and PDA.

## ABS 59

## BOCHDALEK HERNIA WITH INTRATHORACIC KIDNEY ASSOCIATED WITH AORTIC COARCTATION

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INTRODUCTION

Congenital diaphragmatic hernia (CDH) may be associated with other anomalies, most frequently cardiovascular in nature. Intrathoracic kidney is a very rare finding representing less than 5% of all renal ectopias. Intrathoracic ectopic kidney accounts for 5% of all renal ectopias and its association with congenital diaphragmatic hernia has been reported to have an incidence of only 0.25%.

CASE REPORT

In our presentation we are dealing with a male newborn who came as a secondary level transfer, due to suspicion in the diaphragm hernia, and breathing obstruction, with birth weight 3,020 g, from a controlled pregnancy, and performed within

term with cesarean section. After many analyzes and consultants, we diagnosed congenital diaphragmatic hernia with the intrusion of the kidney of the wrists, and after echocardiography we finding a critical aortic coarctation. Due to the baby's condition, the baby was intubated and ventilated for 10 days in a stable condition, and due to the inability to operate him in our center, is was directed for external treatment.

CONCLUSIONS

Fetal echocardiography and perinatal diagnosis over time would enable uterine transport and immediate treatment in an appropriate center for these cases.

## ABS 60

## INHALED NITRIC OXIDE IN CONGENITAL DIAPHRAGMATIC HERNIA – RESULTS FROM THE EUROPEAN INHALED NITRIC OXIDE REGISTRY

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INTRODUCTION

Congenital diaphragmatic hernia (CDH) is associated with pulmonary hypoplasia, abnormal pulmonary vascular development and pulmonary hypertension. Inhaled nitric oxide (iNO), a selective pulmonary vasodilator, is licensed for the treatment of hypoxemic respiratory failure and pulmonary hypertension in term and near-term infants. Despite the lack of convincing evidence of efficacy, it is also frequently used in babies with CDH complicated by pulmonary hypertension. Our aim in this study was to use data from an international registry to describe the short response to iNO and longer term outcomes in infants with CDH.

METHODS

The European iNO Registry was established in 2007 and collects anonymised data about the use of iNO in children from 43 NICUs/PICUs across Europe. The Registry's database was used to conduct a search of all infants with CDH treated with iNO. Information was collected on patient demographics, pre-treatment cardiorespiratory status (including echocardiographic parameters), concomitant therapies, dose and duration of iNO therapy, short-term oxygenation response (defined as a reduction in OI of < 15%), need for ECMO and survival to hospital discharge. We compared baseline characteristics in responders versus non-responders and assessed final outcome according to iNO-response and echocardiographic evidence of pulmonary hypertension (PH).

RESULTS

278 infants with CDH had a median (IQR) gestation of 37 (36-38) weeks and birth weight of 2.86 (2.5-3.29) kg. Of these, 82% were receiving inotropic support, 11% a PDE V inhibitor and 3% an IV vasodilator. Of 208 (75%) infants with CDH in whom a baseline echocardiogram had been performed, 168 (81%) had evidence of PH. Overall there was a significant improvement in short-term oxygenation with an increase in median $paO_2$ from 56 to 63 mmHg ($p < 0.001$) and a corresponding decrease in median OI from 20.8 to 17.3 ($p = 0.005$). 125 (45%) of infants received ECMO and 89 (32%) infants died. Of surviving infants, 16 (6%) developed chronic lung disease at 36 weeks post-menstrual age.

149 (53%) of infants showed a short-term response to iNO. Responders were significantly more likely to have had baseline evidence of PH ($p = 0.05$) and short-term response was also positively associated with survival ($p = 0.01$).

CONCLUSIONS

Although only approximately half of infants with CDH treated with iNO showed a short-term response in oxygenation, early response was associated with improved overall survival. Echocardiographic evidence of PH was not universal in CDH infants treated with iNO. PH was observed more commonly in responders than non-responders suggesting that iNO therapy might be more effective in this sub-group of infants with CDH.

DECLARATION OF INTEREST

The iNO registry is supported by a local hospital charity (The Newborn Appeal) and commercial sponsorship (Linde and SOL Group).

## ABS 61

## EARLY HIGH FREQUENCY VENTILATION – A PROMISE OF PROTECTIVE VENTILATION?

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INTRODUCTION

Despite the advances of conventional mechanical ventilation (CMV) in neonatology, the lung injury associated with it and consequently

bronchopulmonary dysplasia (BPD) are still prevalent. High frequency ventilation (HFV) optimizes pulmonary expansion and reduces tidal volume, with the goal of reducing lung injury. Studies in humans demonstrate that HFV maintains gas exchanges at peak inspiratory pressure (PIP), mean airway pressure (MAP) of the lower airways, and protecting, decreasing pulmonary inflammatory mediators. An attempt to reduce BPD rates and their consequences of early HFV, indicated in our service in the first 7 days of life for very low birth weight (VLBW) infants with mean airway pressure (MAP) greater or equal to 10 mmHg.

METHODS

A retrospective cohort of VLBW infants born in the year 2016 was analyzed, comparing the use of early HFV in the first week of life versus CMV, in patients who received MAP equal to or greater than 10 $cmH_2O$ or the difference between the PIP and positive end expiratory pressure (PEEP) equal or greater than 14 $cmH_2O$. Were excluded patients with congenital malformations, use of HFV as a rescue therapy, transfers from other hospital, congenital infections and death on the first day of life. Were compared: incidence of death, BPD, peri-intraventricular hemorrhage (PIVH) and/or periventricular leukomalacia, SNAPPE-II Score, retinopathy of prematurity (ROP) grade III, air leak syndrome, surgical closure of patent ductus arteriosus, duration of mechanical ventilation, oxygen use, parenteral nutrition and hospitalization.

RESULTS

Nine patients received early HFV and 13 patients received CMV. The mean SNAPPE-II score was 56.6 ± 18.3 in the early HFV group and in the CMV group was 31.8 ± 15.0 ($p < 0.01$). **Tab. 1** compares the evaluated outcomes and no difference between the groups was found. The mean hospital stay in the group that received early HFV was 73.3 ± 49.6 days and the CMV group was 78.7 ± 54 days ($p = 0.81$). The mean time of oxygen supplementation was 51.7 ± 47.1 days in the group that received early HFV and 60.2 ± 56.6 days in the CMV group ($p = 0.89$). The mean duration of mechanical ventilation was 39.2 ± 45.1 days in the early HFV group and 34 ± 38.6 days in the CMV group ($p = 0.39$). The mean duration of parenteral nutrition was 29.5 ± 34.1 days for the early HFV group and 13.9 ± 10.1 days for the CMV group ($p = 0.10$). VLBW infants who used early HFV received higher SNAPPE-II scores.

**Table 1 (ABS 61).** Outcomes according to mechanical ventilation modality.

| Outcomes | Early HFV | CMV | P value |
|---|---|---|---|
| BPD | 3 (50%) | 5 (50%) | 1.00 |
| Death | 3 (50%) | 4 (36.3%) | 0.64 |
| PIVH grade ≥ 3 | 1 (12.5%) | 0 | 0.62 |
| ROP stage ≥ III | 2 (33.3%) | 3 (30%) | 1.00 |
| Surgical PDA | 6 (46.1%) | 6 (66.6%) | 0.41 |

HFV: high frequency ventilation; CMV: conventional mechanical ventilation; BPD: bronchopulmonary dysplasia; PIVH: peri-intraventricular hemorrhage; ROP: retinopathy of prematurity; PDA: patent ductus arteriosus.

CONCLUSIONS

The use of early HFV in very low birth weight preterm infants is feasible and is not associated with increase in morbidities. The group that used HFV, despite being more severe (higher SNAPPE II), presented the same outcomes as the patients with lower severity (CMV group). It is assumed that protection may occur with the use of early HFV, however, further studies are needed to confirm the hypothesis.

## ABS 62

## INHALED NITRIC OXIDE AND PRETERMS: DOOM, GLOOM OR RIGHT? 11 YEARS' EXPERIENCE AT TERTIARY CENTRE

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INTRODUCTION

In spite of limited evidence inhaled nitric oxide (iNO) has found an increased usage in preterm babies' receiving intensive care. It is often used as a last resort for refractory hypoxaemia presumed to be associated with pulmonary hypertension (PHT). Short-term benefits include improved oxygenation and potential reduction in the duration of mechanical ventilation. However there is limited data to suggest it reduces the risk of death, development of bronchopulmonary dysplasia or adverse neurodevelopmental outcome. Aim: To assess risk factors and clinical outcomes, including death and neurodisability, in preterm babies who received inhaled nitric oxide (iNO) at a tertiary neonatal unit.

METHODS

72 preterm babies (defined as < 37 weeks gestation) admitted to the neonatal unit over a period of 11 years from 01/01/2006 to 31/12/2016 and received inhaled nitric oxide (iNO) were

identified via Badgernet and local neonatal unit nitric oxide database. Hospital clinical records were reviewed retrospectively for antenatal risk factors, birth details, ventilation status, use of iNO, records of oxygenation indices, pneumothoraces, interventions, survival and morbidity including chronic lung disease, home oxygen, grade 3 or 4 intraventricular haemorrhage and 2 year neuro-developmental outcomes. 3 case records were not available and in addition 23 were excluded, as there was no evidence of use of iNO in the clinical notes. Overall 46 records were analysed.

RESULTS

Median gestation age and birth weight were 28 ± 5 weeks ($23^{+1}$ - $36^{+5}$) and 1,080 grams (474-2,980 g). 8 were IUGR. 27 (58%) were delivered by Cesarean Section; 57% had antenatal steroids; 19 (41%) had both oligohydramnios and PROM. 26 (56%) died before discharge, 50% of those with oligohydramnios and PROM did not survive. 34 (73%) had PHT and the median age of starting iNO was 1 day (1-165). Median time spent on iNO was 41 hours (1 hour 50 min - 505 hours) and ventilation time 6 days (1 hour - 72 days). 36 (78%) had normal cranial ultrasounds. 5 (10%) had grade 3 or 4 IVH. Infants receiving iNO in the first 72 hours were 4.1 times more likely to survive than those received iNO after 72 hours (OR 4.15, 95% CI 0.97-17.7, p-value 0.05). Of the 20 survivors, 12 (60%) had chronic lung disease, 3 (15%) had global developmental delay at 2 years including 1 requiring hearing aid and SALT input. Results are presented in **Tab. 1**.

CONCLUSIONS

Preterm neonates with PHT receiving iNO within 3 days of life are more likely to respond positively. Positive response is associated with lower mortality as well as lower significant long-term neurodevelopmental problems. Combination of oligohydramnios, prolonged rupture of membranes and pneumothoraces is a poor prognostic sign. Larger clinical trials directed to this specific population are required to validate our results.

**Table 1 (ABS 62).** Characteristics and outcome of the 2 groups.

| | Nitric < 72 hours | Nitric > 72 hours |
|---|---|---|
| **Survived** | 17 (53%) | 3 (21%) |
| **Death** | 15 | 11 |
| **CLD (36 weeks)** | 10 (55%) | 2 (66%) |
| **Home oxygen** | 3 | 1 |
| **Global delay** | 1 (5%) | 2 (66%) |

## ABS 63

## IS APGAR SCORE A PREDICTOR OF SEVERITY IN PRETERM INFANTS?

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INTRODUCTION

Hypoxic-ischemic encephalopathy is a well-known clinical syndrome in term infants, due to an intrauterine or perinatal anoxia event. It also occurs in preterm infants, who present higher incidence in brain injuries in the neonatal period; however, a well-established definition is lacking and outcomes aren´t well known. In term infants, Apgar score is related to neonatal morbidity, mortality and altered neurological development. A low 5-minute Apgar in term infants is associated with a bad prognosis. The objective of this study is to establish if a low 5-minute Apgar score is related to bad outcomes in very low birth weight preterm.

METHODS

We analyzed a retrospective cohort of very low birth weight infants from 2006 to 2015, comparing a group of patients with 5-minute Apgar score < 5 to a group with Apgar score ≥ 5. The outcomes studied were pulmonary hemorrhage, peri-intraventricular hemorrhage (PIVH), retinopathy of prematurity (ROP), patent ductus arteriosus (PDA), necrotizing enterocolitis (NEC), use of vasopressors and inotropes, air leak syndrome, oxygen use over 36 weeks PMA, surfactant replacement therapy and death. The unadjusted risk ratio and the adjusted risk ratio by birth weight and SNAPPE-II were calculated with 95% confidence intervals, through the adjustment of log-binomial regression models. Patients with congenital malformations, those who died and patients with missing data were excluded.

RESULTS

A total of 748 newborns showed 5-minute Apgar score greater than or equal to 5. The mean birth weight of this group was 1,015 ± 292.8 grams. The mean gestational age was 28 weeks and 6 days and the mean length of hospitalization in Neonatal Intensive Care Unit (NICU) was 36 days. A total of 79 newborns were included in the 5-minute Apgar score < 5. The mean birth weight was 755 ± 284 grams and the mean gestational age was 26 weeks. The mean length of hospitalization in NICU was 35

**Table 1 (ABS 63).** Outcomes of patients in relation to Apgar scores.

| Outcomes | Apgar < 5 (%) n = 79 | Apgar ≥ 5 (%) n = 748 | RRa [a] | 95% CI |
|---|---|---|---|---|
| Pulmonary hemorrhage | 20 (25.3) | 123 (16.4) | 1.16 | 0.80-1.67 |
| PIVH grade ≥ 3 | 11 (13.9) | 70 (9.3) | 1.6 | 0.92-2.78 |
| ROP stage ≥ III | 8 (10.1) | 90 (12.0) | 1.63 | 0.78-3.39 |
| PDA | 22 (27.8) | 265 (35.4) | 0.80 | 0.56-1.14 |
| NEC | 3 (3.7) | 57 (7.6) | 0.46 | 0.14-1.45 |
| Inotropes and vasopressors | 34 (43.0) | 182 (24.3) | 2.35 | 1.86-2.98 |
| Air leak syndrome | 16 (20.2) | 87 (11.6) | 1.08 | 0.65-1.80 |
| Oxygen > 36 weeks PMA | 10 (12.6) | 125 (16.7) | 0.98 | 0.54-1.74 |
| Surfactant replacement therapy | 53 (67.0) | 415 (55.4) | 1.07 | 0.97-1.19 |
| Death | 58 (73.4) | 213 (28.4) | 1.09 | 0.99-1.20 |

PIVH: peri-intraventricular hemorrhage; ROP: retinopathy of prematurity; PDA: patent ductus arteriosus; NEC: necrotizing enterocolitis.
[a] Adjusted Risk ratio: weight and SNAPPE II.

days. The 5-minute Apgar score < 5 was associated with air-leak syndrome, surfactant replacement therapy use and death outcomes. These variables were all relevant in unadjusted risk ratio, but when adjusted for birth weight and SNAPPE-II, there was no association. Finally, no association of the 5-minute Apgar score with PDA, NEC, and oxygen use for more than 36 weeks PMA was found. Outcomes of patients in relation to Apgar Scores are presented in **Tab. 1**.

CONCLUSIONS

Very low birth weight preterm infants have an increased risk of many complications in the neonatal period. When using the 5-minute Apgar score as a predictor, we observed that Apgar < 5 is not related to worst evolution in NICU. Other criteria, such as the appropriate sequence of resuscitation management in the delivery room, should be considered for preterm newborns to be associated with subsequent bad outcomes in the NICU.

## ABS 64

## CURRENT PRACTICE OF NEURALLY ADJUSTED VENTILATOR ASSIST IN THE NEONATAL INTENSIVE CARE UNIT: A TAIWAN SURVEY

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INTRODUCTION

Neurally Adjusted Ventilatory Assist (NAVA) has been introduced and applied as a ventilation mode that decreasing patient ventilator asynchrony, which is associated with patient discomfort, sedation usage and leading to better outcomes. Because of the public health policy of Taiwan, the use of NAVA was uncommon in Neonatal Intensive Care Units (NICUs) of Taiwan. The aim of this survey is to determine the current practices of NAVA in NICUs of Taiwan.

METHODS

We conducted a questionnaire survey of current practice of NAVA in NICUs of Taiwan by postal mails. The questionnaire was design to collect information about how to practice NAVA and the cognition in NAVA in the NICUs. The questionnaires were sent to neonatal training program directors from level-III NICUs of Taiwan. The hospital list was downloaded from The Society of Neonatology, Taiwan.

RESULTS

There were 21 level-III NICUs in Taiwan and the response rate was 48% (10/21, 48%). Total 10 NICUs that completed the survey and 5 hospitals (5/10, 50%) have the experience of using NAVA as ventilation support and agreed that NAVA is a safe device for neonates (5/5, 100%). All hospitals used NAVA without any protocol or guideline (5/5,

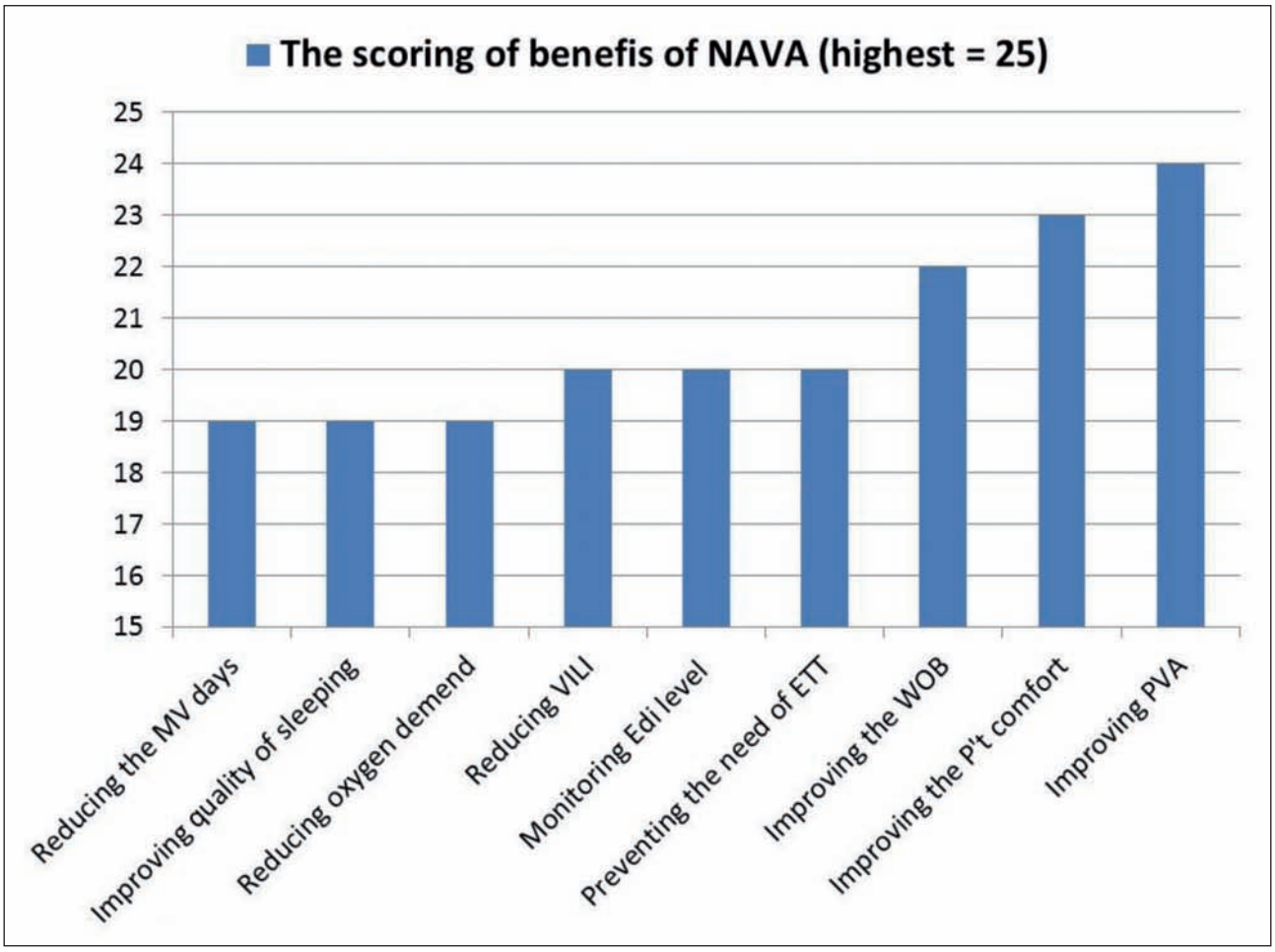


**Figure 1 (ABS 64).** The scoring of benefits of Neurally Adjusted Ventilatory Assist (NAVA).
MV: mechanical ventilation; VILI: ventilator-associated lung injury; Edi: electrical activity of the diaphragm; WOB: work of breathing; PVA: patient-ventilation asynchrony.

100%). The reasons of not use NAVA as routine therapy were too expensively without National Health Insurance reimbursement (9/10, 90%). Results are presented in **Fig. 1**.

CONCLUSIONS

Although the use of NAVA is uncommon in NICUs of Taiwan, in our report the use of NAVA is a safe and comfort ventilation mode for neonates. The neonatologists and respiratory therapists should establish a practice guideline of NAVA and practice it in the NICUs in order to enhance the quality of mechanical ventilation of neonates.

## ABS 65

## LUNG ULTRASOUND FOR THE DIAGNOSIS OF PULMONARY CONSOLIDATIONS IN PATIENTS WITH BRONCHOPULMONARY DYSPLASIA

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INTRODUCTION

Lung ultrasound (LUS) is a highly effective tool of diagnostics and monitoring of pulmonary pathology. The main advantages of lung ultrasound are safety, time and cost effectiveness, feasibility for screening and easy interpretation.

METHODS

We conducted a prospective, single-centre, observational study at the Morozovskaya Children's Clinical Hospital (Moscow, Russia). 76 neonates underwent LUS and chest radiography 2-11 times in NICU. At the postnatal age of 28 days they were divided into 2 groups: group I – 55 infants with bronchopulmonary dysplasia (BPD) and group II – 21 infants without BPD. The mean gestation age of the patients was 27 [26; 28] weeks in group I vs 35 [29; 39] weeks in group II ($p < 0.001$), mean body weight 930 [780; 1,150] g vs 1,880 [1,320; 3,550] g,

respectively (p < 0.001). LUS was performed with linear 6-15 MHz transducer via Loqic S8 ultrasound machine; anterior, lateral and posterior areas of the chest were scanned.

RESULTS

All areas of consolidation had dynamic air bronchograms; we registered pleural line abnormalities and multiple B-lines in all cases and pleural effusion in 11 cases (in 9 patients with BPD and in 2 without BPD). Subpleural lung consolidation of different size is one of the main BPD symptoms. It was registered in 68 patients: in 55 patients with BPD (100%) and in 13 patients without BPD (62%) (p < 0.001). Massive lobar or polysegmental consolidation was registered in 36 (65%) patients with BPD vs 3 (14%) patients without BPD (p < 0.001), segmental consolidation – in 18 (33%) vs 2 (9.5%) patients, respectively, small focal areas of consolidation – in 9 (16%) vs 8 (38%), respectively (p = 0.04). Several types of consolidation in one patient were registered only in patients with BPD – 9 (16%) vs 0, respectively (p = 0.05). Repeated LUS control examinations revealed different dynamic changes in two groups of patients. In neonates with BPD we registered dynamic elevation of size and number of areas of consolidation in 27 (45%) cases vs 0 without BPD, and 18 (33%) patients with BPD died. The other patients with BPD and all patients without BPD had the trend to reduction of the size of consolidation after treatment, before discharge from the NICU.

CONCLUSIONS

LUS is a feasible diagnostic tool in detection of pulmonary consolidation and monitoring the course of pulmonary diseases and infants' response to the therapy. LUS doesn't substitute the chest X-ray but has the potential to reduce the number of X-rays in NICU.

## ABS 66

## NON-INVASIVE HIGH FREQUENCY OSCILLATORY VENTILATION IN PRETERM INFANTS: A RANDOMISED CONTROLLED CROSSOVER TRIAL

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INTRODUCTION

For non-invasive high frequency oscillatory ventilation (nHFOV), high frequency oscillations are superimposed to nasal or pharyngeal continuous positive airway pressure (nCPAP). Case reports and small case series suggest enhanced carbon dioxide ($CO_2$) clearance in premature infants with nHFOV compared to nCPAP. The aim of this randomized controlled crossover trial was to determine whether nHFOV decreases $CO_2$ partial pressure ($PCO_2$) in premature infants more effectively than nCPAP.

METHODS

26 premature infants were randomly allocated to four hours of nHFOV (10 Hz) followed by four hours of nCPAP or vice versa. The mean airway pressures of nHFOV and nCPAP were set at the level equal to the airway pressure prior to the beginning of the study and remained unchanged during the two periods. The amplitude was set so that chest oscillations were visible. The primary outcome measure was $PCO_2$ four hours after commencing the respective mode of respiratory support. Secondary outcome criteria included events of apnoea and bradycardia, respiratory rate, heart rate, pain and/or discomfort scale, mean airway pressure, fraction of inspired oxygen and failure of non-invasive respiratory support.

RESULTS

GA of the patients was 27.0 ± 2.1 weeks. Postnatal age at inclusion was 5 ± 5.2 days. There was no difference in $PCO_2$ after four hours of nHFOV (48 ± 9 mmHg) compared to four hours of nCPAP (50 ± 7 mmHg; p = 0.33). No differences in any secondary outcome measures were seen. nHFOV had to be terminated prematurely for prespecified stopping criteria in 5 cases (increased rate of apnoea [n = 3], hypercapnia [n = 1], hypoxemia [n = 1]).

CONCLUSIONS

We could not demonstrate an increased carbon dioxide clearance applying nHFOV compared to nCPAP in this cohort of preterm infants suffering from RDS. nCPAP was better tolerated than nHFOV.

## ABS 67

## THE EFFECT OF HYDROCHLOROTHIAZIDE WITH SPIRONOLACTONE TREATMENT ON BRONCHOPULMONARY DYSPLASIA DEVEL-

## OPMENT IN VERY-LOW-BIRTH-WEIGHT INFANTS

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### INTRODUCTION

Benefits of diuretic therapy in preterm infants developing bronchopulmonary dysplasia (BPD) have not yet been elucidated. To investigate the effect of combined administration of hydrochlorothiazide with spironolactone therapy on BPD development in very-low-birth-weight (VLBW) infants on respiratory support.

### METHODS

We conducted a retrospective review of medical records of 174 preterm infants with gestational age ≤ 30 weeks born between April 2014 and April 2015 at our tertiary neonatal intensive care unit. Among those, data of the preterm infants still requiring respiratory support on the postnatal 14$^{th}$ day, who received diuretic therapy to prevent BPD were compared with the infants who had never used diuretic therapy. Infants still having ductal patency on the 14$^{th}$ day or received any diuretic therapy before 14$^{th}$ day were excluded.

### RESULTS

Among the 63 infants still requiring respiratory support on the postnatal 14$^{th}$ day, 26 infants received hydrochlorothiazide with spironolactone starting after 14$^{th}$ day of life to prevent BPD and 37 infants received no diuretics. No differences were found regarding BPD development and postnatal steroid use between the treatment and control groups. Mortality, duration of respiratory support, oxygen requirement and hospitalization were also similar between the study groups. The frequency of osteopenia of prematurity was found to be significantly higher in the diuretic group ($p = 0.015$). Hyponatremia was also a significant side effect seen in the diuretic group ($p < 0.001$).

### CONCLUSIONS

Diuretic therapy in preterm infants > 2 weeks of age developing BPD has no benefit on the need for ventilatory support, oxygen requirement, bronchopulmonary dysplasia development and postnatal steroid use while increasing the risk of hyponatremia and osteopenia of prematurity. However randomized controlled trials are required to confirm the safety and effectiveness of diuretic use in infants developing BPD.

## ABS 68

## OUTCOMES OF POSTNATAL HYDROCORTISONE THERAPY IN PRETERM INFANTS WITH BRONCHOPULMONARY DYSPLASIA: EXPERIENCE IN A TERTIARY CENTER

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### INTRODUCTION

Postnatal steroids have been used to prevent or treat bronchopulmonary dysplasia (BPD) in premature infants. However the optimal preparation, dose, and timing for benefit have not been clear yet. To assess the outcomes of very low birth weight infants at risk of BPD treated with hydrocortisone (HC) therapy during a 4-year period in a tertiary center.

### METHODS

We reviewed the charts of 641 infants between 26-30 weeks of gestational age from January 2013 and December 2016. Of those, 75 infants had been treated postnatally with HC according to physicians' choice. HC (cumulative dose 72.5 mg/kg) had been administered during a 22-day tapering schedule. Infants were divided into 3 groups according to the respiratory support requirement at the time of the treatment decision; intubation, noninvasive ventilation and oxygen above 30%.

### RESULTS

Totally 75 infants received HC therapy during this period. Median gestational age and birth weight of the infants were 27 weeks (26-28) and 920 g (830-1,070). Seventeen patients received HC for prolonged ventilator dependency. Thirty-one infants were on noninvasive ventilation and 27 infants were requiring oxygen above 30% at the time of the treatment decision. The characteristics and outcomes of each group were shown in **Tab. 1**. In three cases, the physician decided to stop treatment before 10 days of HC treatment because of sepsis and hypertension. From 17 patients who received HC while being ventilated, 14 infants (82%) could be successfully extubated at 36 weeks postmenstrual age. Six infants (35%) were even free of oxygen. Three patients (17.6%) were still on mechanical ventilation. Home oxygen therapy was prescribed only for 1 patient in this group. Twenty-five out of 31 noninvasively

**Table 1 (ABS 68).** Demographic and clinical characteristics of study groups.

| | MV n = 17 | NIV n = 31 | Free $O_2$ n = 27 |
|---|---|---|---|
| **Birth weight (g)** [a] | 840 (740-960) | 920 (930-1,090) | 1,000 (850-1,080) |
| **Gestational age (week)** [a] | 26.6 (26-27.4) | 27.2 (26-28) | 27.5 (26.4-28.3) |
| **Male, n (%)** | 6 (35) | 17 (55) | 20 (74) |
| **Antenatal steroids, n (%)** | 10 (59) | 16 (51) | 17 (63) |
| **Required surfactant, n (%)** | 17 (100) | 28 (90) | 20 (74) |
| **Treatment for PDA, n (%)** | 11 (65) | 19 (61.3) | 15 (55.6) |
| **Early-onset sepsis, n (%)** | 4 (23.5) | 5 (16) | 5 (18.5) |
| **Late-onset sepsis, n (%)** | 16 (94.1) | 25 (80.6) | 19 (70.4) |
| **PMA 36th weeks respiratory support, n (%)** | None 6 (35,4)<br>Oxygen 3 (17.6)<br>NCPAP 3 (17.6)<br>NIPPV 2 (11.8)<br>MV 3 (17.6) | None 11 (35.2)<br>Oxygen 14 (45.3)<br>NCPAP 4 (13)<br>NIPPV 2 (6.5) | |
| **PMA 36th weeks $FiO_2$** [a] | 32 (27-40) | 28 /25-30) | 27 (25-28) |
| **Postnatal age at start of HC (days)** [a] | 34 (26-49) | 34 (30-43) | 55 (45-64) |
| **Discharge with oxygen** | 1 | 1 | - |

[a] Median (interquartile range).
MV: mechanical ventilation; NIV: noninvasive ventilation; $O_2$: oxygen; IQR: interquartile range; PDA: patent ductus arteriosus; PMA: postmenstrual age: NCPAP; nasal continuous positive airway pressure; NIPPV: nasal intermittent positive-pressure ventilation: $FiO_2$: fraction of inspired oxygen; HC: hydrocortisone.

ventilated infants who received HC were free of noninvasive support (81%) at PM 36 weeks of age.

CONCLUSIONS

Late onset hydrocortisone therapy facilitates extubation, reduces invasive and noninvasive ventilation requirements and helps to discharge newborns without oxygen.

## ABS 69

## NONINVASIVE RESPIRATORY SUPPORT VIA NASAL CANNULA IN PREMATURE INFANTS: IS IT REALLY SAFE?

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INTRODUCTION

Noninvasive ventilation (NIV) is commonly used in neonatal intensive care units. Currently several different devices and interfaces are being used to deliver respiratory support to preterm infants. Although binasal prongs are proven to be the best to deliver nasal continuous positive airway pressure (NCPAP), studies about nasal masks and nasal cannulas (NC) are being reported increasingly. With this observational cohort study we tried to assess whether nasal cannulas originally used to administer high flow could be effectively used as an interface to provide ventilator generated noninvasive respiratory support.

METHODS

Preterm infants with gestational ages between 26th and 30th weeks with respiratory instability that get noninvasive respiratory support with binasal prongs initially and then switched to nasal cannula with attending physician's decision were included. Blood gases and further need for mechanical ventilation were compared between two treatment periods.

RESULTS

The mean gestational age was 28 ± 2 weeks, and the mean birth weight was 1,086 ± 311 g. Six infants (27%) needed intubation and mechanical ventilation while getting noninvasive support via NC, whereas this was not observed during NIV via short binasal prongs (p = 0.021) (**Tab. 1**). Partial carbon dioxide levels and the need for fractionated oxygen were significantly higher in NC period when compared with prong period.

CONCLUSIONS

Although the nasal cannula is easy to use and well tolerated by the preterm infant, it is not as effective as the short binasal prong when it is used as an interface in a mechanical ventilator that provides noninvasive respiratory support other than its own equipment.

**Table 1 (ABS 69).** The comparison of blood gas and nasal continuous positive airway pressure (NCPAP) failure.

| | | Nasal cannulas [a] | Binasal prong [a] | p |
|---|---|---|---|---|
| First day | pH | 7.26 ± 0.05 | 7.29 ± 0.08 | 0.157 |
| | $pCO_2$ (mmHg) | 58 ± 9.91 | 49 ± 9.89 | 0.001 |
| | $FiO_2$ (%) | 32 ± 6.17 | 28 ± 5.60 | 0.002 |
| Second day | pH | 7.28 ± 0.05 | 7.31 ± 0.05 | 0.108 |
| | $pCO_2$ (mmHg) | 60 ± 9.47 | 50 ± 7.43 | 0.002 |
| | $FiO_2$ (%) | 32 ± 8.10 | 28 ± 5.72 | 0.000 |
| Third day | pH | 7.26 ± 0.05 | 7.30 ± 0.05 | 0.050 |
| | $pCO_2$ (mmHg) | 63 ± 10.60 | 50 ± 8.59 | 0.002 |
| | $FiO_2$ (%) | 35 ± 7.60 | 27 ± 5.86 | 0.014 |
| NCPAP failure, n (%) | | 6 (27) | 0 (0) | 0.021 |

$pCO_2$: partial carbon dioxide pressure; $FiO_2$: fraction of inspired oxygen; NCPAP: nasal continuous positive airway pressure.
[a] Results are given as mean ± standard deviation.

## ABS 70

## THE LARYNGEAL MASK AIRWAY AND ITS USE IN NEONATAL RESUSCITATION – A CRITICAL REVIEW OF WHERE WE ARE IN 2017

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### INTRODUCTION

At birth near to 10% of newborns need some kind of respiratory support, hence proficient airway management is the most important aspect of a successful neonatal stabilization and resuscitation. Studies using videotape recordings and respiratory function monitoring have shown that both face mask (FM) application and endotracheal tube placement (ETT) represent a challenge for resuscitators. There is a strong need for devices that can largely be used independent of individual operator training levels to ensure more reliable support in time critical situations, such as neonatal resuscitation. In this scenario, the Laryngeal Mask Airway (LMA) has evolved as a potentially very valuable aid.

### METHODS

An electronic search of "Medline" and "Embase" was performed to identify potentially relevant studies evaluating the use of a laryngeal mask during neonatal resuscitation. We used the following MeSH (headings) database search terms: "Laryngeal Masks or Laryngeal Mask, or Laryngeal Mask Airway or LMA" AND "Infant or Newborn or Neonate" AND "resuscitation". We also searched "clinicaltrials.gov" and "www.isrctn.com" for completed and ongoing trials using similar search terms. We also performed an additional search on "Google Scholar". Two authors independently screened titles and abstracts for potential eligibility and full texts to confirm eligibility. We found 6 relevant Randomised Control Trials (RCTs).

### RESULTS

The observational studies and the randomized controlled trials published in the last decades have shown that LMA may be a valuable device in comparison to FM or ETT. In our review of the six RCTs (**Tab. 1**), results indicate that initial respiratory management of newborn infants with a LMA is feasible. However, evidence is still insufficient, and more high quality RCTs are needed to recommend the use of LMA instead of FM ventilation in delivery room. There is especially a dearth of evidence for use of LMA in neonates born < 34 weeks or < 1,500 g. Finally, the literature does not seem to report any severe complications following the use of LMA. Potential role of LMAs in surfactant administration, epinephrine administration, difficult airways and long term mechanical ventilation has also only been discussed in case reports and observational studies.

**Table 1 (ABS 70).** Overview of Randomised Control Trials (RCTs) comparing Laryngeal Mask Airway (LMA) to other modes.

| Study | Population | Comparison | Main Outcomes |
|---|---|---|---|
| **Esmail et al. (2002)** | GA > 35 weeks; BW > 2,500 g | LMA (n = 20) vs. ETT (n = 20) | Apgar scores; time until heart rate > 100/min; LMA and ETT insertion times; rate of successful insertion with 1st attempt; total number of attempts required; duration of PPV |
| **Singh et al. (2005)** | GA > 35 weeks; BW > 1,500 g | LMA (n = 25) vs. bag and mask (n = 25) | Apgar scores; LMA insertion time; rate of successful insertion with 1st attempt; total number of attempts required; success of ventilation, time required for improvement in colour; duration of PPV |
| **Feroze et al. (2008)** | BW > 1,500 g; Apgar score < 4/10 at birth; Newborns born via C/S | ETT (n = 25) vs. BMV (n = 25) vs. LMA (n = 25) | Apgar scores; LMA and ETT insertion time; rate of successful insertion with 1st attempt; total number of attempts required; success of ventilation, time required for improvement in colour |
| **Zhu et al. (2011)** | GA > 34 weeks or BW > 2,000 g | LMA (n = 205) vs. bag and mask (n = 164) | Apgar scores; LMA insertion time; rate of successful insertion with 1st attempt; total number of attempts required; response time; need for tracheal intubation |
| **Trevisanuto et al. (2015)** | GA > 34 weeks; birth weight > 1,500 g | SLMA (n = 71) vs. face mask (n = 71) | Success of resuscitation device; 5-minute Apgar score; time to the first breath; time to the first cry; death or HIE; complications; admission in NICU or normal nursery |
| **Yang et al. (2016)** | GA ≥ 34 weeks, or BW ≥ 2.0 kg with HR < 60 bpm after 60 s of BMV | LM (n = 36) vs. ETT (n = 32) | First attempt insertion success, insertion time, Apgar score, resuscitation outcome, adverse effects |

LMA: Laryngeal Mask Airway; ETT: endotracheal tube placement.

## CONCLUSIONS

The current evidence suggests that LMA is a feasible and safe alternative to mask ventilation in late preterm and term infants. Further trials are needed to form recommendations on its use in neonatal resuscitation. Evidence is still limited regarding short- and long-term outcomes. Further trials are needed to demonstrate other benefits of LMA including drug delivery, surfactant administration and long-term ventilation.

## ABS 71

## BRADYPREM STUDY: IS HEART RATE THE MOST VITAL OF ALL VITAL SIGNS DURING PRETERM RESUSCITATION?

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## INTRODUCTION

Preterm infants requiring chest compressions and epinephrine at birth are at increased risk of adverse outcomes, including death and neurodevelopmental impairment but the contributing impact of the duration of early bradycardia (defined as heart rate [HR] < 100 bpm anytime during the first 10 minutes after birth) is unknown.

## METHODS

Data from 344 infants < 32 weeks gestation enrolled in 7 randomized control trials concerning bronchopulmonary dysplasia (BPD), retinopathy of prematurity (ROP) and in-hospital mortality were analyzed in relation to the duration of bradycardia. Pulse oximetry was used to determine HR for all infants. Infants were divided into three groups according to the duration of bradycardia: none (N), brief (B, < 2 minutes) and prolonged (P, ≥ 2 minutes). Logistic regression was conducted to account for gestational age (GA) as a confounding variable.

**Table 1 (ABS 71).** Clinical characteristics of the 3 groups.

| | No bradycardia n = 114 | Brief bradycardia n = 111 | Prolonged bradycardia n = 119 | p-value [b] |
|---|---|---|---|---|
| **Male** | 63 (55%) | 66 (60%) | 62 (52%) | NS |
| **GA** [a] | 28 ± 2 | 27 ± 2 | 27 ± 2 | < 0.01 |
| **BW** [a] | 1,143 ± 340 | 971 ± 245 | 991 ± 298 | < 0.01 |
| **Starting $FiO_2$ ≤ 30%** | 53 (47%) | 51 (46%) | 63 (53%) | NS |
| **Starting $FiO_2$ ≥ 60%** | 61 (53%) | 60 (54%) | 56 (47%) | NS |
| **Death and/or IVH** | 9 (7%) | 23 (21%) | 29 (24%) | < 0.01 |
| **Death** | 4 (4%) | 9 (8%) | 19 (16%) | < 0.01 |
| **BPD** | 23 (21%) | 37 (35%) | 30 (26%) | NS |
| **ROP** | 6 (5%) | 7 (7%) | 9 (8%) | NS |
| **IVH** | 5 (5) | 14 (13) | 14 (12) | 0.06 |

[a] Mean ± standard deviation; compared with ANOVA.
[b] p value represent unadjusted analysis between three groups.
GA: gestational age; BPD: bronchopulmonary dysplasia; ROP: retinopathy of prematurity.

## RESULTS

Bradycardia was noted in 230 infants (67%) and 119 (35%) were bradycardic for ≥ 2 minutes. Most infants (226, 98%) were bradycardic within 3 minutes of birth. Bradycardic neonates were more premature (GA: N: 28 ± 2, B: 27 ± 2 weeks, P: 27 ± 2 weeks, $p < 0.01$) and were of lower birth weight (BW: N: 1,143 ± 340, B: 971 ± 245, P: 991 ± 298 grams, $p < 0.01$). Bradycardia duration was positively associated with an increased risk of death and/or IVH (N: 9 [7%], B: 23 [21%], P: 29 [24%], $p = 0.002$) or with mortality alone (N: 4 [4%], B: 9 [8%], P: 19 [16%], $p = 0.004$). These associations persisted even after correcting for GA. There was no difference in IVH alone, BPD or ROP between groups. The risk of death and/or IVH was also increased with the severity of bradycardia. There was no relationship between starting initial $FiO_2$ and bradycardia. Results are presented in **Tab. 1**.

## CONCLUSIONS

Preterm neonates who experience bradycardia during delivery room resuscitation are more likely to die and/or develop IVH. HR therefore remains one of the most important vital signs during resuscitation of preterm infants. Accurate and continuous measurement of HR is critical and should prompt clinicians to quickly identify and treat the cause of bradycardia. Independent contribution of duration and severity of bradycardia during neonatal resuscitation to adverse neonatal outcomes should be further studied.

## ABS 72

## PHYSIOLOGICAL BASIS OF THE NICHD BPD CLASSIFICATION: A PROSPECTIVE OBSERVATIONAL STUDY IN VERY PRETERM INFANTS

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## INTRODUCTION

Current bronchopulmonary dysplasia (BPD) classifications are flawed by local $O_2$ prescribing policies (NICHD), insensitivity to mild BPD (Walsh test) or influence of altitude. The shape of the curve relating arterial vs inspired pressure of oxygen ($SpO_2$ vs $PIO_2$) provides continuous outcome measures of pulmonary gas exchange impairment. Previous studies in preterm infants with BPD were restricted by cohort size (n < 32) and limited to moderate to severe BPD. We aimed to evaluate the $SpO_2$ vs $PIO_2$ curve in a large cohort of very preterm infants to ascertain its use as a measure of BPD severity, and to determine factors predictive for impaired pulmonary gas exchange at 36 w postmenstrual age (PMA).

## METHODS

Prospective observational study of very preterm infants (gestational age < 32 w). A modified oxygen

reduction test was performed at 34-38 w PMA with $PIO_2$ reduced stepwise in 1-3 kPa decrements from 60-14 kPa (as required) to achieve $SpO_2$ from 86-95%. The position and shape of the curve formed by plotting paired values of $SpO_2$ vs $PIO_2$ was analysed relative to the oxyhaemoglobin dissociation curve using a previously validated algorithm. The right shift of the $SpO_2$ vs $PIO_2$ curve, reduced ventilation/perfusion (VA/Q) and shunt were related to current NICHD classification of BPD severity. Potential predictive factors were analysed using principal components analysis and multiple linear regression. Sensitivity and specificity were defined using receiver operating curve (ROC) analysis.

RESULTS

200 infants with median (range) gestational age of 276 (230-316) had a valid study at 353 (335-392) weeks PMA. As NICHD criteria changed from no BPD to severe BPD, mean right shift increased (10.1-17.5 kPa, **Fig. 1**) and VA/Q decreased (0.63-0.44). Shunt was elevated in infants with moderate to severe BPD (7.7-12.3%) compared to infants with no BPD (2.9-3.1%). Infants classified as severe BPD according to NICHD criteria but not requiring supplemental oxygen at 36 w PMA had values of right shift not different from infants with no BPD. Gestation and duration of mechanical ventilation (as an indicator of postnatal illness severity) were the primary independently predictive factors for increased shift, decreased VA/Q and increased shunt. ROC curve analysis revealed a shift threshold of 12.2 kPa for moderate to severe BPD.

CONCLUSIONS

Right shift of the $SpO_2$ vs $PIO_2$ curve is a sensitive and specific marker of BPD severity across the spectrum of BPD and may be useful as a continuous outcome measure of lung disease severity in future randomised controlled trials, and in clinical practice. Infants with severe BPD (NICHD classification) not requiring $O_2$ supplementation may have different underlying pathophysiology.

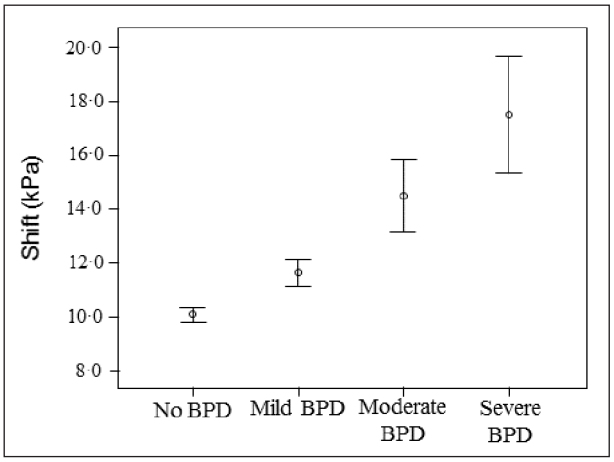


**Figure 1 (ABS 72).** Mean (95% CI) shift (kPa) in relation to NICHD BPD severity.

FUNDING

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## ABS 73

## USING THE COMBINATION OF SURFACTANT AND BUDESONIDE IN THE PREVENTION OF CHRONIC LUNG DISEASE IN PRETERM INFANTS WITH RDS

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INTRODUCTION

More than 60% of the prematurely born survived newborns with GA less than 32 weeks develop a bronchopulmonary dysplasia (BPD) [1]. Moderate and severe forms of BPD significantly reduce the quality of life of children. It is for this reason that it is so important to try to find ways to decrease the incidence and severity of BPD in prematurely born survivors. The purpose is to define whether addition of a budesonide to surfactant replacement, in premature newborns with RDS, decreases the incidence and severity of BPD.

METHODS

We included 68 premature newborns with RDS, who had indications to surfactant replacement, in our prospective randomized trial. 33 children received surfactant as monotherapy (poractant alfa) by LISA technique, 35 children received surfactant in combination with budesonide also by LISA technique. Both groups were comparable considering birth weight, gestational age, Apgar score and presence of mother's infection. We estimated the need for respiratory support at 72 hours after birth and the incidence and severity of BPD as need for respiratory support or oxygen at 28 day of life and at the 36 week of a postconceptional age.

RESULTS

The need for respiratory support was significantly lower in the group of a budesonide with surfactant replacement in comparison with monotherapy with surfactant ($p < 0.003$). The average incidence of

BPD had no differences in both groups, however, the incidence of moderate and severe forms of BPD were significantly ($p < 0.001$) lower in the group, which received treatment with combination of budesonide and surfactant.

CONCLUSIONS

The addition of budesonide to surfactant in LISA technique reduces risk of development of moderate and severe BPD.

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## ABS 74

## NASAL TRAUMA IN PRETERM INFANTS RECEIVING BINASAL NON-INVASIVE RESPIRATORY SUPPORT: A SYSTEMATIC REVIEW

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INTRODUCTION

Binasal prongs are the most commonly used interface for the delivery of nasal continuous positive airway pressure (CPAP) to preterm infants. However, they are associated with pressure-related nasal injury, which causes pain and discomfort. Nasal injury may necessitate a change in interface, type of non-invasive respiratory support and occasionally damage is severe enough to require surgical repair. We aim to determine the incidence and risk factors for nasal injury in preterm infants, and to provide clinicians with strategies to effectively prevent and treat it.

METHODS

We conducted a systematic search of databases including MEDLINE (PubMed including the *Cochrane* Library), EMBASE, CINAHL and Scopus. The search strategy included the search terms: (Neonate*, Preterm, Infant*, Premature, Newborn) AND (respiratory support, CPAP, nCPAP, continuous positive airway pressure, nasal prong*) AND (nasal injury*, skin integrity, skin trauma, skin damage, pressure injury, nasal trauma or nasal injury or nose). The search was limited to studies conducted in humans and with full-text articles published in English prior to 20 February 2017.

RESULTS

The search yielded 1,304 articles and an additional 29 articles were identified from the reference lists of reviewed articles. Full-text reviews of 103 articles were conducted, of which 45 were included in this review. These include 14 randomised controlled trials, 10 observational studies, two cohort studies, eight case reports and 11 reviews. The incidence of nasal injury in preterm infants ranged from 20-100%. Infants born < 30 weeks' gestation are at highest risk. Strategies shown to reduce nasal injury included: nasal barrier dressings (2 studies, n = 244, risk ratio [RR] -0.12, 95% confidence interval [CI] -0.20, -0.04), nasal high-flow therapy as an alternative to binasal prong CPAP (7 studies, n = 1,570, risk difference [RD] -0.14, 95% CI -0.17, -0.10) and nasal masks rather than binasal prongs (5 studies, n = 544, RR 0.80, 95% CI 0.64, 1.00). Results are presented in **Fig. 1**.

CONCLUSIONS

Preterm infants born < 30 week's gestation are most susceptible to nasal injury secondary to CPAP. The use of nasal barrier dressings and nasal masks as

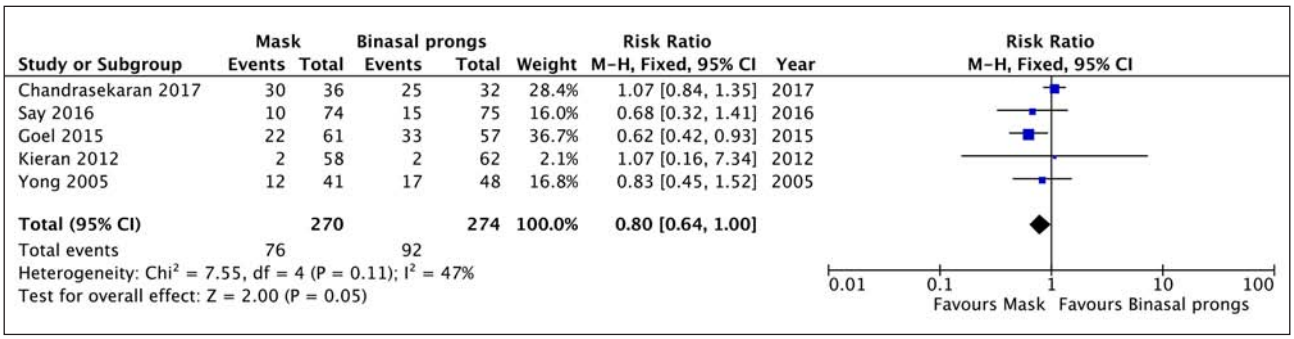


**Figure 1 (ABS 74).** A systematic review of nasal trauma in preterm infants receiving binasal non-invasive respiratory support.

an alternative to binasal prongs may be effective interventions to reduce nasal injury. Nasal high flow causes less nasal injury than CPAP, but it may not provide sufficient respiratory support for the smallest, sickest preterm infants. Larger randomised trials in this population that include a blinded, standardised assessment of nasal skin integrity are required to determine whether these strategies are effective in clinical practice.

## ABS 75

## EVALUATION OF EFFECT OF CAFFEINE ONSET TIME ON SURFACTANT SYNTHESIS OF PREMATURE INFANTS ≤ 30 WEEKS OF GESTATIONAL AGE WITH RESPIRATORY DISTRESS

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### INTRODUCTION

Caffeine is a common drug used in preterm infants. Its use has been shown to reduce the duration of respiratory support and the rate of chronic lung disease in this population. This may be due to caffeine's effects on stimulation of respiratory center and/or surfactant synthesis. However there is no clinical study related to caffeine's mechanism of action on stimulation of surfactant synthesis. In this study, we aimed to investigate the effects of caffeine onset time on endogenous surfactant synthesis in preterm infants.

### METHODS

Randomized controlled prospective study, between March 2015 and November 2016 enrolling preterm infants of 30 weeks' gestation and below admitted to the neonatal intensive care with respiratory distress. Preterm infants with spontaneous breath, followed in nasal continuous positive airway pressure (nCPAP) and completed antenatal steroid doses were divided into two groups according to onset of caffeine: early caffeine group (caffeine started within postnatal first 6 hours) and late caffeine group (caffeine started in postnatal 48$^{th}$ hour). Tracheal aspirate samples were taken at the postnatal 6$^{th}$ hour (LBC1) and postnatal 48$^{th}$ hour (LBC2).

### RESULTS

A total of 153 patients recruited this study; 64 in the early caffeine group and 89 in the late caffeine group. Patients birth weight and gestational weeks didn't show differences between the groups. In early caffeine group LBC1 and LBC2 counts were 11,000 (1,000-71,000)/µl and 36,000 (4,000-240,000)/µl respectively, and in the late caffeine group, LBC1 and LBC2 counts were 15,000 (2,000-80,000)/µl and 38,000 (6,000-224,000)/µl, respectively. There was no difference in total LBC count between the groups (p: 0.93 and 0.406 respectively). In both groups, LBC2 counts were higher than LBC1 ($p < 0.001$ and $< 0.001$). Non-invasive and invasive respiratory support times, severe ROP, severe IVH and BPD rates were similar between groups (p: 0.61, 0.35, 0.609, 0.65, 0.87 and 0.69, respectively).

### CONCLUSIONS

In patients treated with nCPAP, LBC count and endogenous surfactant synthesis are increased independently of early or late caffeine treatment. However early caffeine treatment doesn't influence the rate of surfactant synthesis compared to late caffeine group.

## ABS 76

## OCTREOTIDE FOR CHYLOTHORAX? A SYSTEMATIC APPROACH TO ANSWERING THE QUESTION

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### INTRODUCTION

Octreotide is a somatostatin analog that is used off-label for the management of patients with refractory chylothorax. In 2010, a *Cochrane* meta-analysis concluded that there were not sufficient data to support the adoption of octreotide as a treatment strategy for chylothorax. The authors recommended the organization of prospective registries to create the background knowledge leading to a prospective study. Our tertiary referral neonatology center will promote such a prospective registry and, to guide the definition of entry criteria of the registry, we performed a retrospective analysis of cases collected in the last 5 years. Preliminary data are reported here.

**Table 1 (ABS 76).** Patient characteristics.

| | Idiopathic group | | | | | | Surgical group | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 | Mean | (± SD) | Case 6 | Case 7 | Case 8 | Case 9 | Case 10 | Mean | (± SD) | p-value |
| **Birthweight (g)** | 1,880 | 2,300 | 2,150 | 2,330 | 3,610 | 2,454 | (± 670.3) | 3,260 | 1,850 | 2,750 | 3,500 | 1,780 | 2,628 | (± 790.4) | NS |
| **Gestation (weeks + days)** | $29^{+0}$ | $33^{+5}$ | $34^{+0}$ | $35^{+3}$ | $36^{+4}$ | | | $34^{+1}$ | $35^{+4}$ | $35^{+0}$ | $38^{+0}$ | $37^{+0}$ | | | |
| **Sex** | M | M | F | M | F | | | F | F | M | M | M | | | |
| **Respiratory support** | | | | | | | | | | | | | | | |
| **Total duration (days)** | 157 | 61 | 179 | 43 | 5 | 89 | (± 75.3) | 28 | 44 | 30 | 75 | 48 | 45 | (± 18.9) | NS |
| **IMV (days)** | 64 | 51 | 56 | 11 | 5 | 37.4 | (± 27.3) | 17 | 6 | 21 | 45 | 26 | 23 | (± 14.3) | NS |
| **CPAP (days)** | 12 | 10 | 123 | 32 | 0 | 35.4 | (± 50.3) | 11 | 0 | 9 | 17 | 22 | 11.8 | (± 8.3) | NS |
| **$O_2$ support** | 81 | 0 | 0 | 0 | 0 | 16.2 | (± 36.2) | 0 | 38 | 0 | 13 | 0 | 10.2 | (± 16.5) | NS |
| **Duration of hospital stay (days)** | 157 | 53 | 179 | 74 | 59 | 104.4 | (± 59.1) | 61 | 80 | 62 | 98 | 72 | 74.6 | (± 15.2) | NS |
| **Total duration of chest drains (days)** | 40 | 25 | 25 | 21 | 33 | 28.8 | (± 7.6) | 24 | 14 | 27 | 24 | 23 | 22.4 | (± 4.9) | NS |
| **Days to reach full enteral feeds** | 50 | 34 | 22 | 26 | 49 | 36.2 | (± 12.9) | 36 | 67 | 29 | 59 | 44 | 47 | (± 15.8) | NS |
| **Octreotide** | | | | | | | | | | | | | | | |
| **Total duration** | 13 | 11 | 13 | 59 | 40 | 27.2 | (± 21.5) | 11 | 1 | 7 | 50 | 8 | 17.6 | (± 18.2) | NS |
| **Start dose (µg/kg/h)** | 0.5 | 1 | 0.5 | 0.5 | 0.5 | 0.6 | (± 0.2) | 2 | 0.5 | 1 | 0.5 | 1 | 1 | (± 0.6) | NS |
| **Maximum dose (µg/kg/h)** | 2 | 2 | 0.5 | 6 | 6 | 3.3 | (± 2.5) | 2 | 0.5 | 1 | 4 | 1 | 1.7 | (± 1.4) | NS |

METHODS

We reviewed the medical records of all infants diagnosed with chylothorax from January 2012 to March 2017 at our institution. Based on the etiology of chylothorax (surgical vs. idiopathic), we classified patients into two groups, and we compared them for the parameters shown in **Tab. 1**, using Wilcoxon/Mann-Whitney test.

RESULTS

Ten cases of chylothorax (6 males), managed with octreotide after the failure of conventional therapy were identified: in 5/10 a surgical etiology was likely, while no cause could be identified in the remaining 5 and they were therefore considered as idiopathic chylothorax. Mean gestation was 34.6 ± 2.5 weeks and birth weight was 2,541 ± 696.9 g. The mean duration of chest drains was 25.6 ± 6.9 days. We found no differences in the clinical course of patients. Therapy was initiated at a mean age of 21 ± 15 days at a starting dose of 0.5-1 µg/kg/h that was titrated up to a maximum dosage of 6 µg/kg/h, based on clinical response. The median duration of treatment was 22 days (range 7-59). Full enteral feeding was reached at a mean age of 42 days. Resolution of chylothorax was achieved in all patients, and none reported adverse effects related to the administration of the drug.

CONCLUSIONS

This small population cannot define the efficacy of octreotide. However, data will help to design our registry: the starting and maximum doses seem appropriate given the lack of side effects and favorable outcomes. Lack of differences between surgical and idiopathic cases encourages enrolling both series of patients. The low incidence of the disease calls for a partnership with other centers to define the efficacy of octreotide.

## ABS 77

## PERINATAL INFLAMMATION AND INTRAUTERINE GROWTH RETARDATION ARE BOTH ASSOCIATED WITH LUNG FUNCTION IMPAIRMENT AT 12 YEARS OF AGE IN VERY PRETERM INFANTS

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INTRODUCTION

Pulmonary disease after very preterm birth may cause permanent lung damage and as a consequence, lung function impairment in long-term survivors. The etiology is multifactorial, where perinatal inflammation is one of several identified risk factors. The aim of this study was to evaluate if systemic inflammation early after birth in very preterm infants was related to lung function at preadolescent age. We hypothesized that increased proinflammatory activity would be associated with BPD and with later lung function impairment.

METHODS

Pulmonary function testing (spirometry and diffusion capacity, DLCO, before and after inhalation of salbutamol) was done at 12.6 ± 0.3 (mean ± SD) years of age in 54 children, born at a mean gestational age of 27.8 weeks, recruited from a cohort of very preterm infants followed since birth. Lung function parameters were compared with inflammatory biomarkers (IL-6, IL-8 and IL-10) previously analyzed postnatally at 6, 24, 48 and 72 h after birth and with prospectively collected clinical neonatal data from birth until discharge. Mean cytokine levels (6-72 h) were calculated by area under curve (AUC) during the corresponding time period. Bronchopulmonary dysplasia (BPD) was defined as need for supplemental oxygen at 36 weeks postmenstrual age.

RESULTS

There was no correlation between birth weight and lung function in adolescence, but magnitude of intrauterine growth retardation, measured as (predicted – actual)/predicted birth weight (%), was associated with a lower forced expiratory volume in 1 sec (FEV1; p = 0.02), lower vital capacity in % of predicted normal (% pred; p = 0.042), lower DLCO (% pred; p = 0.005) and lower alveolar volume (p = 0.009). No association was seen between magnitude of intrauterine growth retardation (%) and presence of BPD. Infants diagnosed with BPD (25/54 infants, 46%) had higher AUC for IL-6, IL-8 and IL-10 in the first 72 h after birth (p = 0.009, p < 0.001 and p = 0.001). FEV1, FEV1%, maximum mid expiratory flow (MMEF) and MMEF (% pred) at 12 years of age were inversely correlated to AUC for IL-6 early after birth (p = 0.019, p = 0.006, p = 0.016 and p = 0.019, respectively; **Fig. 1**).

CONCLUSIONS

In this cohort of very preterm infants, presence of growth retardation at birth as well as perinatal inflammation were risk factors for later impaired lung function at 12 years of age. Long-term follow up with lung function tests might be useful in preterm infants with specific risk factors.

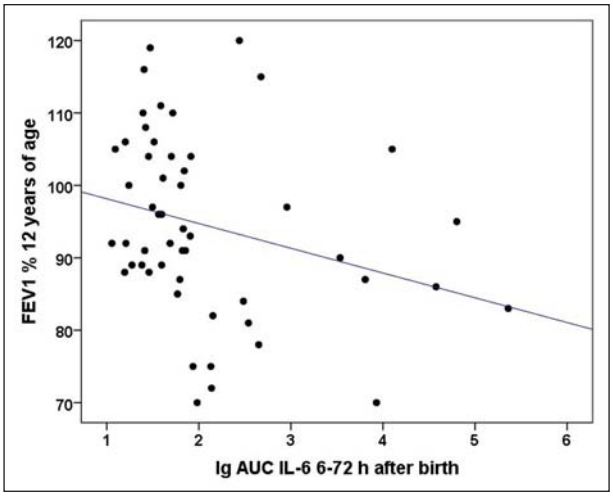


**Figure 1 (ABS 77).** Inverse correlation between FEV1 at 12 years of age and AUC for IL-6 early after birth.

**ABS 78**

## ALVEOLAR SURFACTANT COMPOSITION IN PRETERM INFANTS WITH RESPIRATORY DISTRESS SYNDROME BEFORE EXOGENOUS SURFACTANT ADMINISTRATION: EFFECT OF GESTATIONAL AGE AND INFLAMMATION

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INTRODUCTION

It is well known that pulmonary surfactant deficiency is the main cause of Infant Respiratory Distress Syndrome (RDS). However, knowledge about the surfactant components is still scarce. Studies report that little mature protein is detected in lung tissue of preterm infants. The aim of this study was to examine the composition of the alveolar surfactant in preterm infants with RDS at different gestational ages (GA).

METHODS

Eighty-five newborns with GA ≤ 32 weeks with RDS and 11 term infants without lung disease

**Table 1 (ABS 78).** Clinical characteristics and laboratory markers.

| | Group A 23 ≤ GA ≤ 28 weeks n = 42 | Group B 28 < GA ≤ 32 weeks n = 43 | p | Term n = 11 |
|---|---|---|---|---|
| **Clinical variable** | | | | |
| **Birth weight (g)** | 734 ± 174 | 1,213 ± 322 | 0.000 | 3,284 ± 385 |
| **GA (weeks)** | 25.7 ± 1.4 | 29.8 ± 1.3 | 0.000 | 39.2 ± 1.2 |
| **Age ss (h)** | 1.0 (0.4-3.6) | 3.5 (1.1-12.8) | 0.000 | 141.0 (17.3-1,688.0) |
| **IUGR (%)** | 25% | 26% | 0.362 | |
| **OI** | 8.1 (5.5-9.9) | 6.3 (3.4-7.8) | 0.002 | |
| **MAP** | 8.5 (7.8-9.4) | 8.3 (6.2-8.9) | 0.029 | |
| **$FiO_2$** | 0.40 (0.30-0.60) | 0.35 (0.30-0.46) | 0.073 | |
| **$AaDO_2$** | 198.5 (116.6-315.4) | 158.1 (106.6-238.5) | 0.042 | |
| **$PaO_2/FiO_2$** | 106.4 (88.5-157.7) | 132.8 (91.1-186.3) | 0.072 | |
| **Total MV (days)** | 8.9 (5.7-40.2) | 1.9 (0.8-4.1) | 0.000 | |
| **Total amount of surfactant (mg/kg)** | 245 (200-300) | 200 (200-270) | 0.016 | 0 |
| **BPD at 28 gg (%)** | 79% | 36% | 0.000 | 0% |
| **BPD at 36 GA (%)** | 47% | 26% | 0.013 | 0% |
| **Histological chorioamnionitis %** | 38% | 9% | 0.001 | |
| **Laboratory data** | | | | |
| **DSPC (mg/mL of ELF)** | 0.87 [0.31-3.74] | 0.60 [0.25-1.15] | 0.216 | 3.34 [2.0-6.5] |
| **SP-A (ug/mL of ELF)** | 19.2 [5.7-68.6] | 13.8 [3.2-28.2] | 0.058 | 32.3 [27.0-42.6] |
| **SP-B (ug/mL of ELF)** | 10.5 [5.1-19.5] | 5.9 [3.7-16.3] | 0.143 | 7.2 [3.3-9.0] |
| **MPO (mU/mL of ELF)** | 630 [57-1,828] | 52 [0-699] | 0.009 | 2 [0-102] |

GA: gestational ages; DSPC: Desaturated Phosphatidylcholine; ELF: Epithelial Lining Fluid.

were enrolled. Preterm infants were divided in two groups, the first one with 23 ≤ GA ≤ 28 weeks (Group A) and the second one with 28 < GA ≤ 32 weeks (Group B). Tracheal aspirate (TA) samples and 60-100 ul of blood sample were collected at birth, before the administration of exogenous surfactant. TA Desaturated Phosphatidylcholine (DSPC) was measured by gas-chromatography; TA albumin and myeloperoxidase activity (MPO) by a colorimetric assay; SP-A and SP-B by ELISA. Urea concentration in the TA and in plasma was also measured and the values were used to estimate TA dilution.

RESULTS

Clinical characteristics and laboratory markers are reported in **Tab. 1**. Group A had higher incidence of histological chorioamnionitis (Chorio) than Group B (38% vs 9%; p = 0.01) and higher TAs MPO activity (p < 0.01). Preterm newborns had significantly less Epithelial Lining Fluid (ELF) DSPC than term infants (p < 0.01) and Group B had significantly lower SPA concentration than term infants (p < 0.01) whereas Group A had similar SP-A and SP-B as to in term infants. We found that infants in Group A with Chorio had more DSPC (3.00 [0.59-6.29] vs 0.55 [0.16-1.04] mg/ml; p = 0.003), more SP-B (12.7 [6.6-35.0] vs 5.8 [3.7-10.3] ug/ml; p = 0.021) and SP-A (24.1 [10.5-63.0] vs 12.5 [3.0-27.9] ug/ml; p = 0.043) than infants without Chorio. MPO was higher in Group A with Chorio (1,513 [560-2,210] vs 14 [0-294] mU/ml; p < 0.00001) compared to Group A without Chorio.

CONCLUSIONS

Preterm infants at birth and before surfactant administration had consistent amount of DSPC, SP-A and SP-B especially those with Chorio. However, inflammation induced by chorioamnionitis could significantly affect surfactant synthesis and inactivation and lung maturation. Further studies with a larger number of infants will help us to determine the role of inflammation in the development of chronic lung disease.

## ABS 79

## BLOOD GLUCOSE LEVEL AND CEREBRAL OXYGENATION IN NEONATES IMMEDIATELY AFTER BIRTH

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## INTRODUCTION

Cerebral oxygenation during immediate transition after birth is influenced by oxygen delivery and oxygen consumption, whereby especially consumption depends on metabolic cell activity. Aim was to investigate impact of blood glucose on "Cerebral Regional Oxygen Saturation" ($crSO_2$) and "Fractional Tissue Oxygen Extraction" (FTOE) of cerebral tissue in term and preterm neonates 15 minutes after birth.

## METHODS

Post-hoc analysis of secondary outcome parameters of several prospective observational studies was performed. Preterm and term neonates were included, in whom i) cerebral near-infrared-spectroscopy (NIRS) measurements were performed during immediate transition after birth and ii) blood glucose levels were measured between 15 to 20 minutes after birth. Arterial oxygen saturation ($SpO_2$) and heart rate (HR) were measured by pulse oximetry. cFTOE was calculated. To investigate a potential association between $crSO_2$ and cFTOE 15 minutes after birth and blood glucose correlation analyses were performed.

## RESULTS

Seventy-five neonates were included. In 25 preterm neonates $SpO_2$, HR, $crSO_2$ and FTOE were 93.9 ± 5.1, 159 ± 15, 80.2 ± 12.1, and 0.15 ± 0.1, respectively. In 50 term neonates $SpO_2$, HR, $crSO_2$ and FTOE were 96 ± 3.2, 157.1 ± 19, 83 ± 7.7 and 0.14 ± 0.08, respectively. $crSO_2$ and FTOE correlated significantly with blood glucose levels in term and preterm neonates. Increasing glucose levels was associated with decreasing $crSO_2$ in term ($q = -0.35$, $p = 0.01$) and preterm neonates ($q = 0.31$, $p = 0.01$) and was associated with increasing FTOE in term ($q = -0.56$, $p = 0.01$) and preterm ($q = 0.67$, $p = 0.01$) neonates.

## CONCLUSIONS

Blood glucose levels are associated with cerebral oxygenation 15 minutes after birth, suggesting a deep impact of metabolism on cerebral oxygenation during immediate transition after birth.

## ABS 80

## EARLY PREDICTIVE FACTORS FOR INSURE FAILURE IN THE MANAGEMENT OF PRETERM INFANTS WITH NEONATAL RESPIRATORY DISTRESS SYNDROME: A SYSTEMATIC REVIEW

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## INTRODUCTION

Early surfactant administration using the INSURE procedure (INtubation-SURfactant-Extubation) combined with nasal CPAP from birth, has become standard management for respiratory distress syndrome in preterm infants. However, not all preterms tolerate the procedure and some require reintubation and mechanical ventilation. Knowledge of early predictive factors for INSURE failure could enable neonatologists to select only those infants for INSURE procedure who have a good chance of success. Our aim for this systematic review was to identify early predictive factors for failure of the INSURE procedure in preterm infants with respiratory distress syndrome.

## METHODS

This review is registered at PROSPERO with registry number CRD42015025138. MEDLINE, EMBASE and the *Cochrane* Central Register of Controlled Trials (CENTRAL) were searched (until Dec 2015) for original studies. In addition, reference lists were checked. Original studies comparing INSURE success with INSURE failure in preterm infants with RDS were included. Restrictions were languages other than English, French, German and Dutch. Case reports/series and articles for which only the abstract was available were also excluded. A pre-specified form was used for data extraction. Risk of bias was assessed using the SIGN checklists. All steps were performed by 2 reviewers, independently.

## RESULTS

A total of 516 records were identified of which 10 studies met inclusion criteria (1,131 patients, range 21-322). Substantial variation existed in study population, INSURE procedure and outcome definitions. Methodological quality varied from high to very low, only 4 studies performed a multivariate analysis. We identified 16 risk factors including birth weight, gestational age and severity of respiratory distress. Evidence for birth weight was inconsistent, with a trend of higher risk of INSURE failure in extremely low birth weight infants. There was a significant association between

decreasing gestational age and risk of INSURE failure. RDS severity was assessed in multiple ways, using arterial blood gas values, imaging and scoring systems. Different classifications and cut-off values were used for the same predictor across studies making it difficult to draw firm conclusions.

CONCLUSIONS

Extremely low birth weight, low gestational age and severe RDS appear to be important risk factors for INSURE failure. However, most evidence is inconsistent due to important methodological heterogeneity across studies. Therefore, clinical applicability of these results is limited at the moment and implies the need for future large cohort studies on this subject.

## ABS 81

## OUTCOMES OF POSTNATAL DEXAMETHASONE USE IN EXTREME PRETERM NEONATES IN A TERTIARY NEONATAL UNIT

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INTRODUCTION

Postnatal dexamethasone is effective in preventing and treating chronic lung disease by reducing lung inflammation and facilitating extubation of ventilator-dependent preterm infants. There are short and long term side effects, with increased risk of neurodisability including cerebral palsy. Historical studies relied on evidence in which steroids were often used early (first week of life) in higher doses and longer courses than recent practice – with a total cumulative dose much higher than current regimens being used. Our aim was to evaluate current postnatal treatment in extreme preterm infants, assess risk factors and review outcomes.

METHODS

We conducted a retrospective cohort study on $23^{+0}$ to $28^{+6}$ weeks gestation neonates admitted to NICU over 6 years from 01/01/2011 to 31/12/2016. Neonates were identified from the BadgerNet and hospital databases, and divided into two subgroups: Group A (23 to 25 weeks gestation) and group B (26 to 28 weeks). Data was collected from BadgerNet as well as written and electronic medical records and prescription charts. Variables evaluated included: Chronic lung disease (CLD), surgically treated patent ductus arteriosus (PDA), retinopathy of prematurity (ROP) stage 3 and above, culture positive sepsis, necrotising enterocolitis (NEC), grade 3-4 intraventricular haemorrhage (IVH), cystic periventricular leukomalacia and survival to discharge.

RESULTS

435 infants were included; 73 infants (16.8%) were treated with dexamethasone (26.4% in group A). In a randomly selected sample the average cumulative dose of dexamethasone was 1.87 mg/kg (range 0.3-3.35 mg/kg, average duration 16.9 days). In the dexamethasone group, there was no reduction in CLD diagnosis, 6.8% had a surgically treated PDA and 5.5% had a grade 3-4 IVH. A higher incidence of culture-positive sepsis was noted in the dexamethasone group (30.1%) compared to the control group (13.5%). 27.4% of babies receiving dexamethasone were diagnosed with stage 3+ ROP (9.4% in the control group). Confirmed and/or perforated NEC was seen in 9.6% of the dexamethasone group and 12.9% of the control group. 66.6% of the dexamethasone group

**Table 1 (ABS 81).** Outcomes of postnatal dexamethasone use in extreme preterm neonates, in a tertiary neonatal unit.

| | | Total (n) | CLD | PDA | Sepsis | ROP | IVH | cPVL | NEC | Survival to discharge |
|---|---|---|---|---|---|---|---|---|---|---|
| **Dexamethasone group** | **23-25 weeks GA** | 39 | 27 | 4 | 10 | 12 | 2 | 1 | 4 | 73.9% |
| | **26-28 weeks GA** | 34 | 27 | 1 | 12 | 8 | 2 | 2 | 3 | 59.1% |
| | **23-28 weeks GA** | 73 | 54 | 5 | 22 | 20 | 4 | 3 | 7 | 66.6% |
| **Control group** | **23-25 weeks GA** | 109 | 48 | 1 | 18 | 14 | 14 | 2 | 17 | 46.2% |
| | **26-28 weeks GA** | 253 | 76 | 0 | 31 | 20 | 13 | 4 | 30 | 86.6% |
| | **23-28 weeks GA** | 362 | 124 | 1 | 49 | 34 | 27 | 6 | 47 | 75.1% |
| **Total population** | **23-25 weeks GA** | 148 | 72 | 5 | 28 | 26 | 16 | 3 | 21 | 53.3% |
| | **26-28 weeks GA** | 287 | 106 | 1 | 43 | 28 | 15 | 6 | 33 | 84.5% |
| | **23-28 weeks GA** | 435 | 178 | 6 | 71 | 54 | 31 | 9 | 54 | 73.6% |

GA: gestational age; CLD: chronic lung disease; PDA: surgically treated patent ductus arteriosus; Sepsis: culture positive sepsis; ROP: retinopathy of prematurity stage 3 or above; cPVL: cystic periventricular leukomalacia; NEC: confirmed/perforated necrotising enterocolitis;

survived to discharge, compared to 75.1% not given dexamethasone (73.9% versus 46.2% of the control group in sub-group A) (**Tab. 1**).

CONCLUSIONS

Postnatal dexamethasone was used in just over a quarter of neonates under 26 weeks gestational age. Cumulative overall dose given appeared to be reduced compared to historical cohorts. Outcomes were approximately in keeping with existing data, with a possible improved survival but also increased risk of sepsis and stage 3 ROP in extreme preterm infants. Further multi-centre studies may be required to demonstrate statistical significance.

## ABS 82

## A RANDOMISED CONTROLLED TRIAL OF NEEDLE ASPIRATION OR CHEST DRAIN INSERTION FOR PNEUMOTHORAX IN NEWBORNS (THE NORD TRIAL), ISRCTN65161530

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INTRODUCTION

Treatment options for symptomatic pneumothorax in newborns include needle aspiration and chest drain insertion. There is little consensus between clinicians as to the preferred treatment, reflecting a lack of evidence from clinical trials to support practice. We wished to determine whether treating a pneumothorax diagnosed on chest X-ray (CXR) in newborns receiving respiratory support (endotracheal [ET] ventilation, continuous positive airways pressure [CPAP] or supplemental $O_2$ > 40%) with needle aspiration compared to immediate chest drain insertion resulted in fewer infants having chest drains inserted within 6 hours of diagnosis.

METHODS

In this international multicentre randomised controlled trial, infants receiving respiratory support who had a pneumothorax on CXR that the clinician deemed needed treatment, were randomly assigned to drainage using needle aspiration or chest drain insertion. Randomisation was stratified by centre and gestation at birth (< 32/≥ 32 weeks). Participants were randomised once only and treating clinicians were not masked to group assignment. Infants assigned to "needle aspiration" had needle aspiration initially; if treating clinicians deemed that the response was inadequate a drain was inserted. Infants assigned to "chest drain insertion" had a drain inserted. Our primary outcome was whether a chest drain was inserted on that side for the treatment of a pneumothorax within 6 hours of diagnosis.

RESULTS

We enrolled 70 infants and the groups were well matched at study entry (**Tab. 1**). Fewer infants randomly assigned to needle aspiration had a chest drain inserted within 6 hours (OR [95% CI] 0.55 [0.4-0.75], number need to treat [NNT] = 2); and during hospitalisation (OR [95% CI] 0.7 [0.56-0.87], NNT = 3). Among infants < 32 weeks, fewer infants assigned to needle aspiration had a drain

**Table 1 (ABS 82).** Patient characteristics at study entry and outcomes.

| | Needle aspiration n = 33 | Chest drain n = 37 | p value |
|---|---|---|---|
| **Gestational age (weeks)** [a] | 31 (27, 38) | 31 (27, 35) | 0.669 |
| **GA < 32 weeks** [b] | 17 (52) | 22 (59) | 0.631 |
| **Birth weight (g)** [a] | 1,385 (1,100, 3,365) | 1,690 (1,060, 2,025) | 1.000 |
| **Male** [b] | 16 (48) | 22 (59) | 0.472 |
| **ET ventilation at study entry** [b] | 14 (42) | 17 (46) | 0.813 |
| **CPAP at study entry** | 16 (48) | 20 (54) | 0.811 |
| **Chest drain within 6 hours** [b] | 18 (55) | 37 (100) | < 0.001 |
| **Chest drain insertion before discharge** [b] | 23 (70) | 37 (100) | < 0.001 |
| **Death before hospital discharge** [b] | 7 (21) | 2 (5) | 0.074 |

[a] Median (IQR), compared with Independent samples median test; [b] n (%), compared with Fisher's exact test.
ET: endotracheal; CPAP: continuous positive airways pressure.

inserted within 6 hours (12/17 [71%], vs. 22/22 [100%], p = 0.01).

CONCLUSIONS

Needle aspiration significantly reduced the rate of chest drain insertion in symptomatic newborns with pneumothorax on CXR. Needle aspiration should be used for the initial management of pneumothorax in symptomatic newborns.

## ABS 83

## VALIDATION OF A TRANSCUTANEOUS $TCPO_2$/ $TCPCO_2$ SENSOR WITH AN OPTICAL OXYGEN MEASUREMENT IN PRETERM NEONATES

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INTRODUCTION

Neonatal hyperoxemia has detrimental effects on lung and brain development and increases mortality. Pulse oximetry, the current standard, measures arterial oxygen non-invasively. However, it is not sensitive to higher blood oxygen levels. Transcutaneous sensors continuously measure $O_2$ and $CO_2$ diffusing from the locally heated neonatal skin and estimate arterial levels. Conventional technology is hindered by measurement drift, requiring frequent calibration. The new fluorescence quenching technique for measuring oxygen is potentially drift free. This study aims to validate transcutaneous oxygen ($TcPO_2$) and carbon dioxide ($TcPCO_2$) measurements to arterial blood gas samples and determine drift.

METHODS

A study on transcutaneous monitoring, using the OxiVenT Sensor (SenTec AG, Switzerland) in preterm neonates (24-32 weeks GA) with an arterial catheter. Local protocols were used for sensor temperatures and site times for preterm (≥ 26 GA: 43°C 3 h) and extremely preterm (< 26 GA: 42°C 2 h) neonates. $TcPCO_2$ was calibrated when site time elapsed, $TcPO_2$ was calibrated daily for verification, and used to asses measurement drift. $TcPO_2$ and $TcPCO_2$ values were logged and compared to arterial blood gas samples that were taken as standard of care. Samples taken when measurements were unstable (± 0.5 kPa $TcPO_2$ or $TcPCO_2$ change within 10 min) were excluded. Samples from a day before till a week after a positive blood culture were deemed septic and analyzed separately. Results are presented as median (IQR).

RESULTS

Sixty-nine patients were included with a GA of $26^{4/7}$ ($25^{2/7}$-$27^{4/7}$) weeks and an average age during the measurements of 6 (3-10) days. As part of the study 656 blood samples were collected; 413 samples were excluded because of unstable measurements and 5 samples were excluded because the site time was exceeded and the temperature lowered at the time the sample was taken. A total of 238 samples were analyzed. Sixty-eight of the samples from 22 patients were taken during periods of suspected sepsis. One hundred and ninety-seven samples were taken with a sensor temperature of 43°C, 41 samples at 42°C. The agreement between arterial $O_2$ and $CO_2$ values and all stable transcutaneous $O_2$ and $CO_2$ values are shown in Bland-Altman plots (**Fig. 1**). Drift of $TcPO_2$ and $TcPCO_2$ was 0.07 (-0.08 to 0.24) kPa/day and 0.54 (-0.22 to 1.49) kPa/day, respectively.

CONCLUSIONS

Agreement of $TcPO_2$ and $TcPCO_2$ was in line with literature on conventional sensors. Suspected sepsis had negative effects on the agreement for $O_2$, but did not affect the agreement for $CO_2$. The sensor showed negligible drift for the optically measured $TcPO_2$ during clinical use. This study shows that there is great potential for drift-free optical techniques in transcutaneous monitoring.

DECLARATION OF INTEREST

The equipment for this study was provided by SenTec AG, Switzerland.

## ABS 84

## SUCCESSFUL VENTILATION VIA ACCIDENTAL OESOPHAGEAL INTUBATION IN A CASE OF FLOYD TYPE III/FARO TYPE B TRACHEAL AGENESIS IN A DISCORDANT MONOZYGOTIC TWIN

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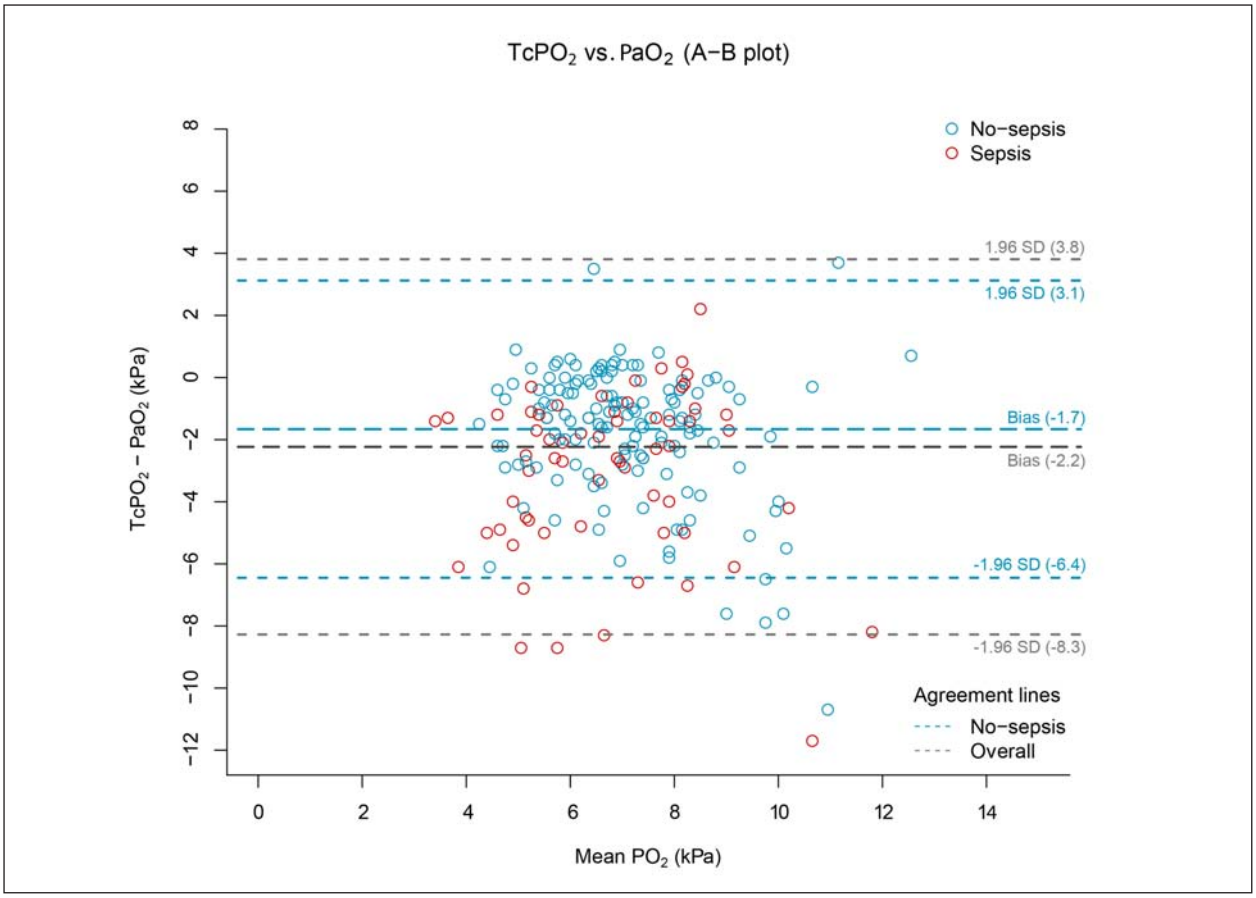
INTRODUCTION

Tracheal atresia (TA) is a very rare congenital anomaly with complete or partial absence of the

A.




B.

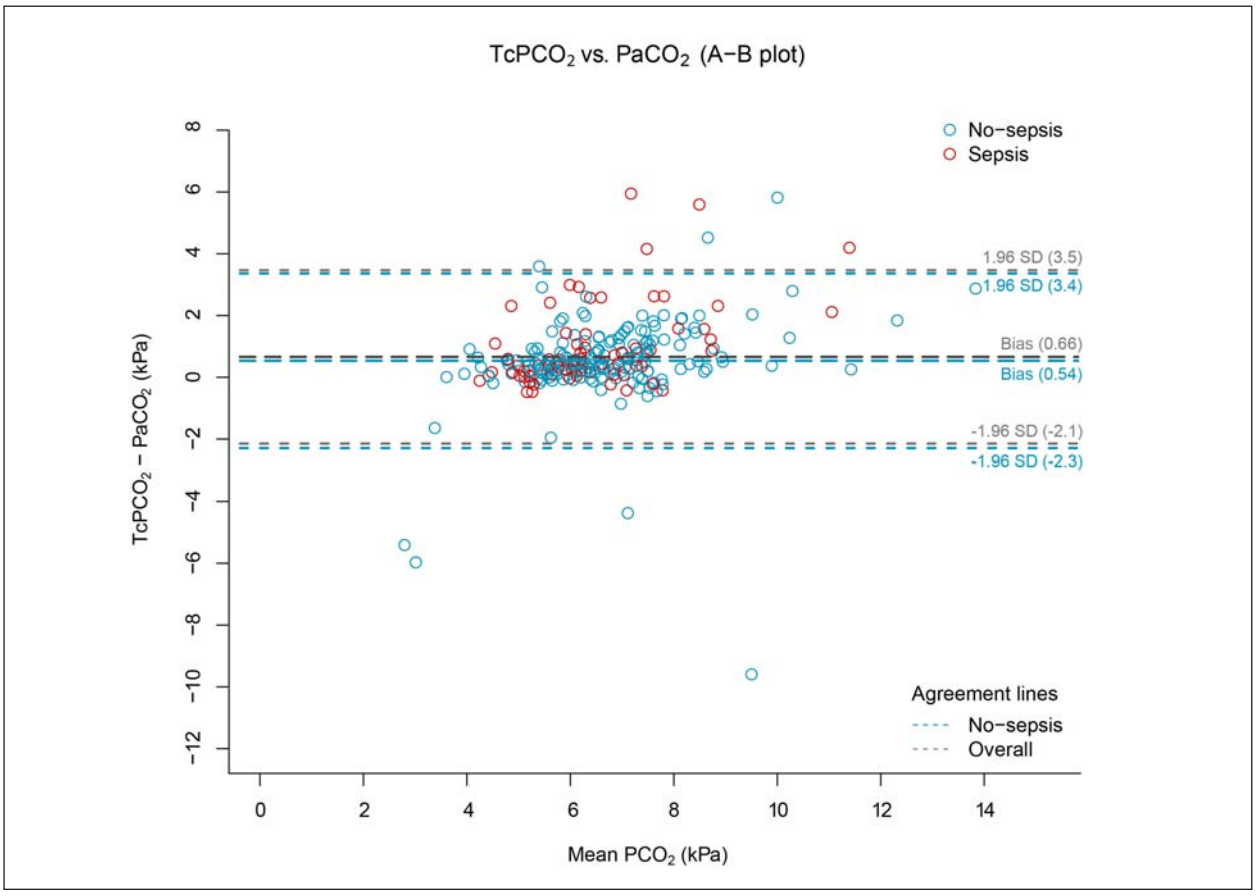



**Figure 1 (ABS 83).** Bland-Altman plots of the agreement of transcutaneous measurement of **A**) the optically measured $TcPO_2$ with $PaO_2$ and **B**) the electrochemically measured $TcPO_2$ with $PaO_2$.

trachea below the larynx with an incidence of < 1:50,000 and a M/F ratio 2:1 first described by Payne in 1900. It may be isolated or part of a syndrome and may be associated with or without (Congenital High Airway Obstruction Syndrome – CHAOS) a tracheo-oesophageal fistula and usually not amenable to surgical repair and therefore eventually fatal. Reported worldwide cases amount to < 200. It was usually a diagnosis made at postmortem. We present an unusual case of Floyd Type III/ Faro Type B TA in a discordant monozygotic twin, successfully ventilated via the oesophagus who had other congenital anomalies.

CASE REPORT

26 yr old para 2 mother found on serial antenatal scans to have a monochorionic diamniotic (MCDA) pregnancy with growth discrepancy, but no features of twin-to-twin transfusion. Twin 1 had single umbilical artery (SUA), dilated bowel loops, and Tetralogy of Fallot (TOF). Twin 2 continued to do well throughout. Delivered at $32^{+4}$ by C/section. Twin 2 was born in good condition with subsequent uneventful neonatal stay. Twin 1, BWt 1,410 g (< 9th centile), did not cry at birth, had signs of respiratory distress and was difficult to intubate and only successfully at 4th attempt, ETT size 3, 7.5 cm at lip with equal bilateral air entry and subsequently required very minimal ventilatory support and normal gases throughout. NGT tip was present in the gastric bubble. However, he had persistent "triple bubble" on abdominal Xrays (**Fig. 1A**), had not passed meconium on day 3, with a patent anus. Decision was made for transfer for surgical exploration. Postnatal Echo confirmed TOF/ DORV; left sided arch with retro-oesophageal right subclavian. Accidental extubation whiles being prepared for surgery and subsequent difficulties with multiple re-intubation attempts with successful ventilation with oesophageal intubation, therefore suspicion of TA with broncho-oesophageal fistula. Urgent bronchoscopy showed presence of vocal cords but absent trachea. Perfluorocarbon instilled via pinhole at larynx pooled (**Fig. 1B**). CT chest: no patent trachea, ET tube and NGT both within oesophagus, Rt and Lt main bronchi arising from the lower oesophagus, i.e., Floyd Type 3/Faro Type B TA (**Fig. 1C** and **Fig. 1D**).

MDT discussion with parents as lesion is not amenable to reconstruction and therefore re-direction of care. Genetics showed chromosomal deletion on the short arm of X chromosome. This is a very rare case of monozygotic discordance for TA with other congenital anomalies for which there has been only two other reported cases described in literature. Temporary survival of our patient was dependent on ventilation via oesophageal intubation, which is possible in all Floyd types of TA. However, the Faro's classification is more extensive and includes cases in which ventilation through ETT in the oesophagus will not be feasible. TA is associated with a wide variety of congenital anomalies. In our case this included, polyhydramnios, SUA, TOF with retro-oesophageal right subclavian and possibility of jejunal atresia (JA). JA was likely from the polyhydramnios, persistent "triple bubble", not passed meconium at day 3. However, surgical exploration was deferred due to redirection of care.

CONCLUSIONS

A very rare case of Type III (Floyd's) or Type B (Faro's) TA with broncho-oesophageal connection and other congenital anomalies in a discordant monozygotic twin is presented. Temporal survival was possible through initial inadvertent oesophageal intubation and ventilation.

## ABS 85

## PROTOCOLIZED WEANING IN MECHANICAL VENTILATION

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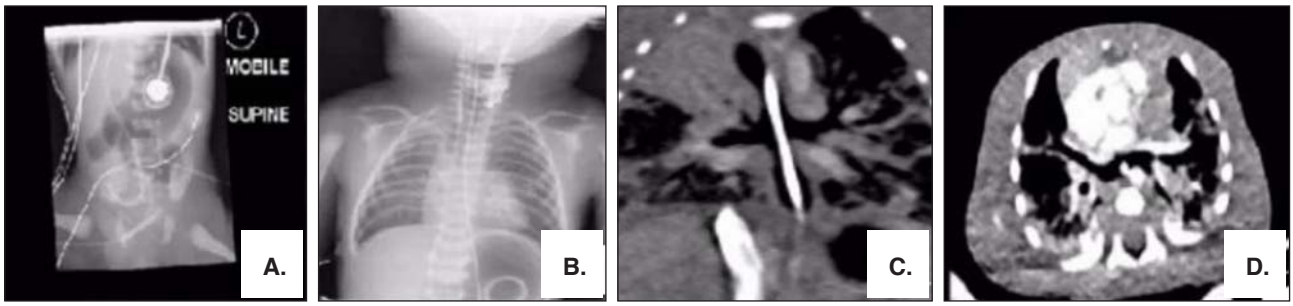


**Figure 1 (ABS 84).** For an accurate description of the figures, see the text.

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## INTRODUCTION

Mechanical ventilation (MV) is one of the most used treatments in neonatology. Prolonged MV is associated with deleterious outcomes, such as developmental disorders and/or delays, such as bronchopulmonary dysplasia (BPD) and even death. Weaning protocols are used to achieve extubation in a safe and uniform manner, as quick as possible. The aim of this study was to evaluate the available evidence for protocolized weaning during invasive mechanical ventilation. Therefore a systematic review was conducted including all available literature on protocolized versus non-protocolized weaning.

## METHODS

All types of studies involving neonates, participating in the selected studies, were included. All types of studies were included which investigated or described protocolized versus non-protocolized weaning in neonates. The following databases were searched: the Cochrane Central Register of Controlled Trials; MEDLINE (1950 until present); EMBASE (1988 until present); CINAHL (1982 until

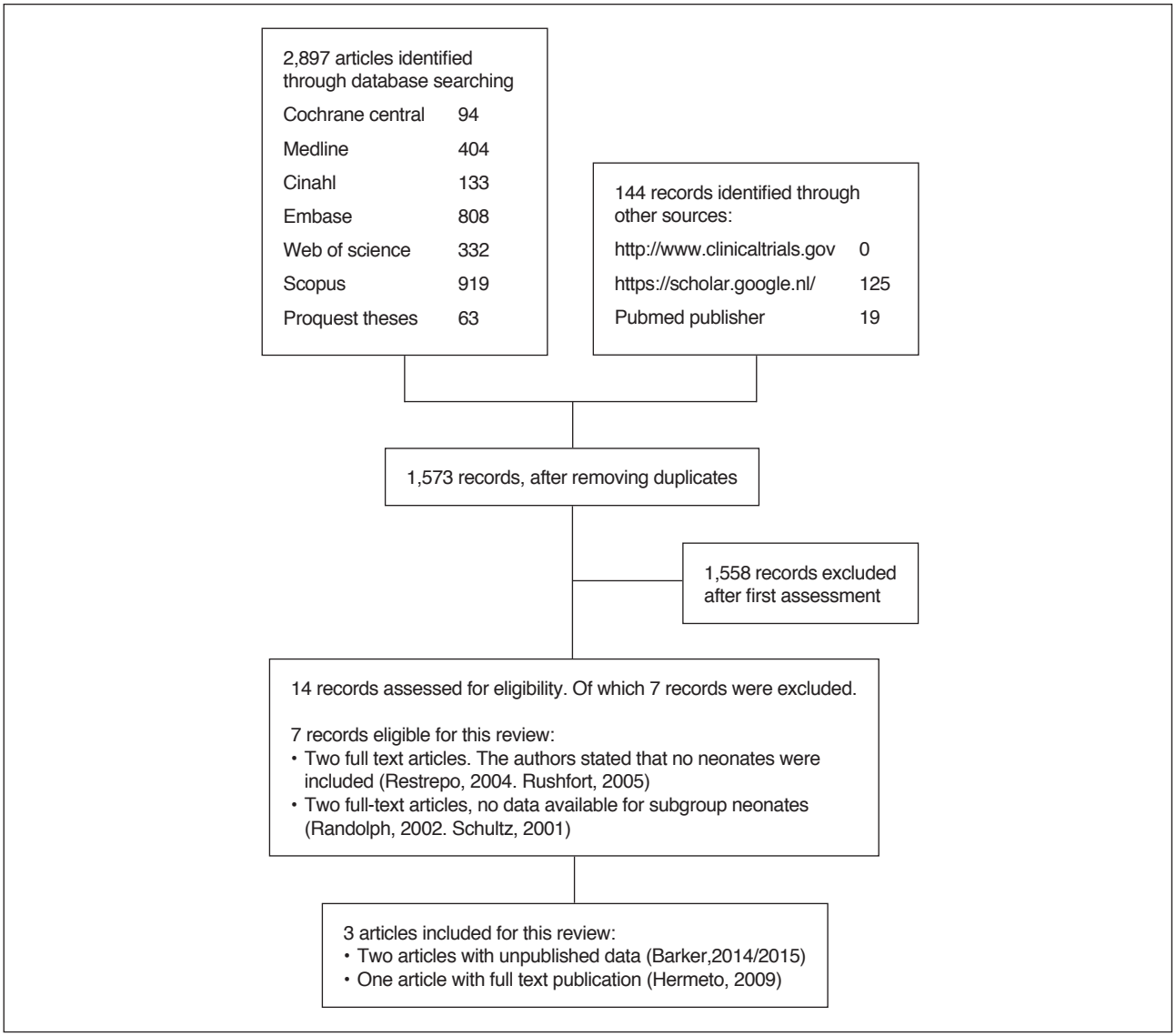


**Figure 1 (ABS 85).** Flowchart of the study.

present); Web of Science (1990 until present); and the International Clinical Trial Registry Platform (2004 until present).

The primary outcome was the difference in weaning duration. Secondary outcomes were mortality between the two groups, length of stay, incidence of MV related morbidity.

RESULTS

After searching all databases a total of 1,537 articles were retrieved. Of these 14 articles met the inclusion criteria and were assessed for further evaluation. 7 articles were excluded for different reasons; such as a study setting in the PICU, no protocol described for the weaning phase or a nurse versus registrar led weaning trial. 7 articles were eligible, but only three could be included in this review (included flowchart, **Fig. 1**). Barker (2014/2015) presented two studies at the annual congress of the Perinatal Society of Australia and New Zealand (PSANZ) in 2014 and 2015. Until now no article was published. Only the study by Hermeto et al. [1] was assessed. They conducted a retrospective study performed in a single center tertiary NICU. 300 patients were included. The mean weaning time decreased from 18 to 5-6 days. There were no differences in secondary outcomes.

CONCLUSIONS

Although there is compelling evidence for the use of a weaning protocol in the adult ICU, it almost doesn't exist for the Neonatal Intensive Care Unit. Despite virtually no evidence a Canadian survey among Neonatal Intensive Care Units showed that 38% of the tertiary NICU's has a protocol to guide the use of MV [2]. As the study of Hermeto et al. [1] showed promising results, more research on protocolized weaning in MV should be conducted.

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[2] Shalish W, Anna GM. The use of mechanical ventilation protocols in Canadian neonatal intensive care units. Paediatr Child Health. 2015;20(4):e13-9.

## ABS 86

## WHAT IS THE IDEAL TARGET PRETERM POPULATION THAT MIGHT BENEFIT FROM THE EXPENSIVE PALIVIZUMAB PROPHYLAXIS?

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INTRODUCTION

Palivizumab is a monoclonal antibody that reduces the likelihood of serious respiratory tract infection by Respiratory Syncytial Virus (RSV) in infants with Chronic Lung Disease (CLD) defined as an ongoing oxygen requirement at 36 weeks corrected gestation. In the United Kingdom (UK), Palivizumab is offered to high-risk infants with moderate to severe CLD according to their chronological age at the time of RSV season as per Joint Committee on Vaccination and Immunisation (JCVI) guidelines. The American Academy of Pediatrics (AAP), in contrast, recommends Palivizumab prophylaxis for all infants born before 29 weeks' gestation who are younger than 12 months at the start of the RSV season.

METHODS

We hypothesised that the RSV hospitalisation rate and length of hospital stay (LOS) within the 1st year of life between preterm babies with CLD immunised according to the JCVI criteria (CLDJCVI) and the additional babies who are considered eligible by the AAP criteria would be comparable. Our cohort included babies born in Nottingham UK between 2009 and 2015. Data was collected from hospital records and the Nottingham CLD database, and analysed using Fisher's exact test for proportions and Mann-Whitney test for continuous data.

RESULTS

In total there were 3,478 babies born preterm (< 37 weeks GA) in Nottingham UK from 2009 to 2015. 459 babies were born in Nottingham at < 29 weeks GA. 245 babies had CLD at 36 weeks corrected GA and 135 of these babies were eligible for Palivizumab (JCVI). Results are presented in **Tab. 1**.

**Table 1 (ABS 86).** Comparison between RSV hospitalisation rate and length of hospital stay (LOS) within the 1st year of life between preterm babies with chronic lung disease immunised according to the JCVI criteria and the additional babies who are considered eligible by the AAP criteria.

| Number of babies | Babies immunised according to JCVI criteria | Additional babies who would be eligible by AAP criteria | p-value |
|---|---|---|---|
| **Total** | 135 | 160 | |
| **Confirmed RSV hospitalisations following discharge from neonatal unit within 1st year of life** | 13 (9.6%) | 13 (8.13%) | 0.68 |
| **Median LOS in days (IQR)** | 10.3 days | 6.92 days | 0.5 |

JCVI: Joint Committee on Vaccination and Immunisation; AAP: American Academy of Pediatrics; RSV: Respiratory Syncytial Virus; LOS: length of hospital stay.

CONCLUSIONS
The RSV hospitalization rate and LOS were not statistically different in babies under JCVI criteria and additional babies qualifying by AAP criteria. A larger multi-centre prospective study is required to prove health and economic benefits of adopting AAP Palivizumab recommendations.

## ABS 87

## EVALUATION OF OXIDATIVE STRESS IN NEONATES

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INTRODUCTION
Newborns oxidative stress is augmented by different conditions like prematurity, asphyxia, respiratory distress, intraventricular hemorrhage. The aim of the study was to evaluate the oxidative stress of newborns with different pathological condition and different gestational age.
METHODS
We conducted a prospective non randomized study. In the study group 86 patients with different gestational age were enrolled. They had associated different conditions, which are generating oxidative stress. In each patient malonildialdehyde (MDA) was measured by Satoh's method. In 14 patients the carbonyl protein value was also measured as well by Reznick's method for the study of protein peroxidation process. Two measurements were done in the study group, on the first and third day of life, respectively.
The controls consist in 25 healthy term newborns. In the controls, one measurement was done on the first day of life. For all patients family's consent was obtained. The statistical analysis was done using Statistica Program.
RESULTS
MDA value and carbonyl protein as well increased in patients with different form of respiratory distress. The other studied pathologies had no significant influence on oxidative stress markers value. The MDA value of study group decreased on third day of life but carbonyl protein had different behaviour. The protein oxidation process lasted longer than lipid peroxidation of study group.
CONCLUSIONS
In the current study the respiratory distress augmented the oxidative stress. Other conditions had no significant influence on oxidative stress. For carbonyl protein better evaluation larger studies are required.

## ABS 88

## ACCURACY OF OBTAINING NEONATAL HEART RATE FROM A NOVEL HAT MOUNTED, GREEN WAVELENGTH OPTICAL DEVICE

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INTRODUCTION
A newborn's heart rate (HR) is the most important determinant of the need for and effectiveness of resuscitation. The ECG is recommended in the delivery room to monitor HR if available (ILCOR 2015) but application of electrodes can be challenging and electrical cardiac activity doesn't always equate to adequate cardiac output. Use of pulse oximetry (POx) can underestimate the HR in the first few minutes of life and is unreliable in poor perfusion states [1]. We aimed to develop a newborn hat with an integrated green light photoplethysmography (PPG) HR sensor (SurePulse-SP) which can be quickly sited on the forehead offering an alternative to ECG and POx.
METHODS
Babies were recruited from the neonatal unit (NNU) and prior to birth by term elective caesarean section (ECS) at the Nottingham University Hospitals NHS Trust. The SP hat was sited on the forehead and compared to ECG and pre-ductal POx for up to 30 minutes. Babies were excluded if there was no ECG data to compare, a protocol violation occurred or a device became detached from the patient. Manual checks were carried out against the raw ECG trace if the ECG HR and the test device HR diverged by ± 20%. The R-R intervals from the raw ECG trace over the disputed time period were calculated

manually. Data was excluded if the ECG HR and the HR derived from the R-R interval of the raw ECG trace deviated by > 10%. Accuracy was determined using Bland-Altman analysis. Ethical approval was given.

## RESULTS

A total of 60 babies (NNU = 40, ECS = 20) were recruited. After exclusions, 12,278 paired SP/ECG and 13,635 paired POx/ECG data points from 35 babies on the NNU (median 36 weeks; IQR 33-38 weeks) and 18 babies born by CS (median 39 weeks; IQR 39-39$^{+6}$ weeks) were included. The Bland-Altman plots of HR differences for all patients showed SP and POx, compared to the ECG, had similar bias (-0.2; 0.2) but SP HR had narrower limits of agreement (LOA) (± 1.96 SD) 7.6, -8.0 than POx HR 10.1, -9.7 (**Fig. 1**). The Root-Mean-Square difference values of ECG HR-SP HR was 3.9 bpm compared to 5.0 bpm for ECG HR-POx HR. For subgroups analysis of NNU babies, SP (bias -0.2, LOA 7.5, -8.0) and POx (bias 0.1, LOA 7.7, -7.5) were comparable. For the ECS group, SP (bias 0, LOA 8.0, -8.0) performed better with narrow LOA compared to POx (bias 0.7, LOA 19.83, -18.35).

## CONCLUSIONS

Forehead PPG offers an accurate, hands free alternative to POx and ECG in the delivery room. With the increasing use of delayed cord clamping, the challenges of attaching POx sensors, ECG leads and their cables, whilst considering temperature control, cannot be underestimated. Incorporating a wireless optical HR sensor within a hat ensures the normal care pathway is followed and could offer a number of advantages over existing methods.

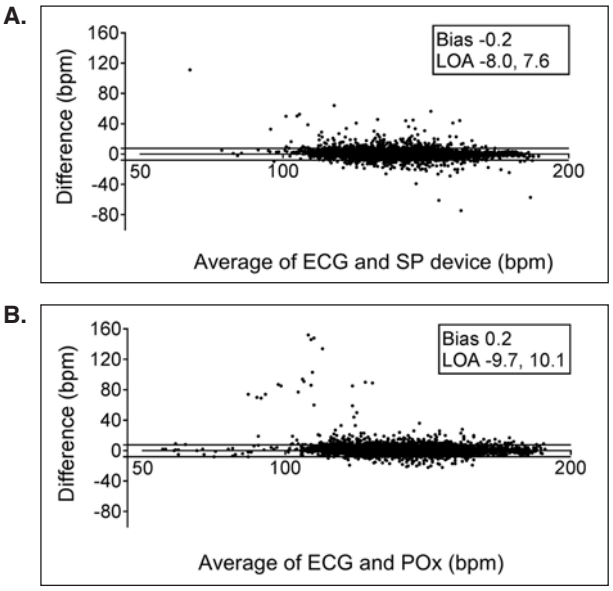


**Figure 1 (ABS 88).** Bland-Altman plots of neonatal heart rate differences. Difference is plotted between ECG and SP device (**A**) and between ECG and POx (**B**).

## DECLARATION OF INTEREST

Don Sharkey, Barrie Hayes-Gill and James Carpenter sit on the board for SurePulse Medical Ltd. Damon McCartney is the Principal Engineer for SurePulse Medical Ltd.

## REFERENCE

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## ABS 89

## EFFECTS OF SURFACTANT REPLACEMENT THERAPY WITH PORCINE VS. BOVINE PREPARATIONS ON CEREBRAL OXYGENATION AND BIOELECTRIC ACTIVITY OF PRETERM INFANTS

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## INTRODUCTION

Surfactant administration is an invasive procedure. Acute changes in cerebral oxygenation and alteration of aEEG activity following surfactant replacement therapy (SRT) in the preterm infants have been reported. Animal studies have shown varying physiologic responses with different surfactant preparations. There were also significant differences in clinical outcome in the comparison trials of bovine surfactant (Beractant) and porcine surfactant (Poractant alfa). However, it remains uncertain whether this was caused by source of preparation or dose. The aim of the study was to compare cerebral oxygenation and bioelectric activity during SRT with porcine and bovine drug preparations.

## METHODS

Preterm infants with respiratory distress syndrome, requiring intubation and mechanical ventilation with $FiO_2 > 0.4$, and gestational age (GA) of 26-30 weeks were enrolled in the study. They were randomized to

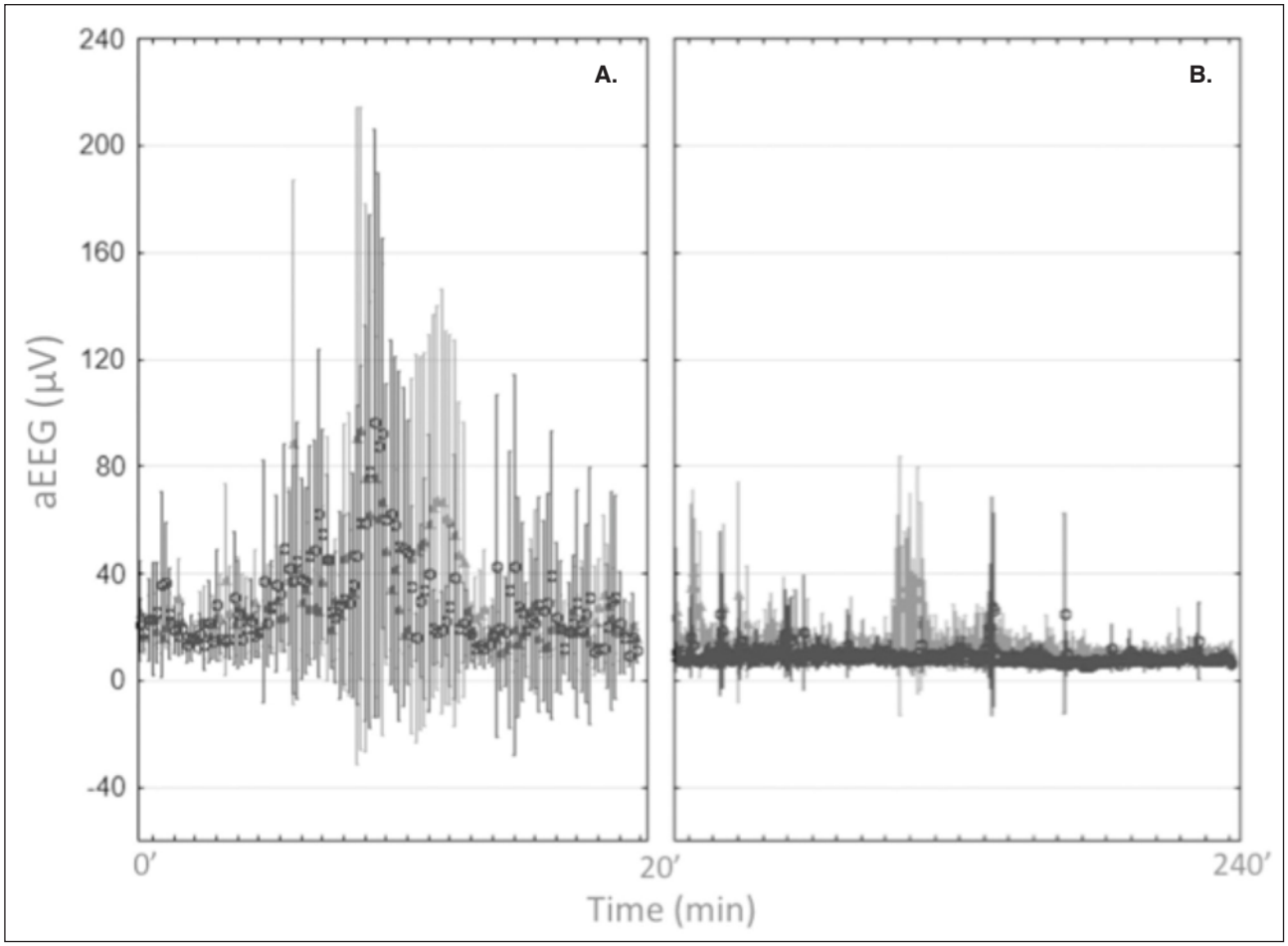


**Figure 1 (ABS 89).** aEEG voltage values before, during, and after surfactant replacement therapy. Values presented as mean (dots, triangles) and confidence intervals (vertical lines). Dots and black lines represent Poractant, triangles and grey lines – Beractant. During the first phase of the study data were sampled at the rate of 10 seconds (window "**A**"), during the second phase at the rate of 1 minute (window "**B**").

one of the treatment groups: 1) SRT with Poractant alfa (200 mg/kg) or 2) SRT with Beractant (100 mg/kg). Recordings of saturation measured with pulse oximetry ($SpO_2$), heart rate (HR), cerebral tissue oxygenation ($StO_2$) measured with NIRS, and amplitude-integrated electroencephalography (aEEG) were started 5 minutes before SRT and continued for 4 hours. One-way non-parametric repeated measures ANOVA followed with multiple post-hoc comparison test, and two-sample Wilcoxon rank-sum test were used for statistical analysis.

RESULTS

The study enrolled 22 patients (11 in each group). There were no significant differences in the mean birth weight and GA: 1,075 g vs. 1,057 g and 27.2 weeks vs. 27.7 weeks, respectively. No significant differences in $SpO_2$, HR and $StO_2$ were found between groups. Immediately after SRT there was a peak in aEEG voltage followed by signal depression in both groups. Mean aEEG voltage values did not vary significantly between the two preparations (**Fig. 1**) but there was a significant difference in the percentage of time with aEEG signal < 5 μV after SRT between groups (mean 25.7% for Poractant vs 16.5% for Beractant), 30 seconds between the two groups (38.4% for Poractant vs 21.6% for Beractant, $p < 0.05$).

CONCLUSIONS

This is a first study comparing aEEG and $StO_2$ recordings during SRT with two different natural surfactant preparations. Both surfactants influenced mean values of $StO_2$ and aEEG voltage in a similar manner. Percentage of time with aEEG signal 30 seconds after SRT varied significantly between groups suggesting that SRT effects on selected parameters of brain bioelectric activity may depend on the type of preparation used.

## ABS 90

## INCIDENCE AND OUTCOME OF PNEUMOTHORACES IN A TERTIARY NEONATAL INTENSIVE CARE UNIT

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## INTRODUCTION

Pneumothorax remains a significant morbidity especially among preterm ventilated babies in neonatal units. There is also a proportion of babies who present with spontaneous pneumothoraces. Our aim was to review the incidence and outcomes of pneumothoraces in a tertiary neonatal intensive care unit.

## METHODS

All chest X-rays between 01/04/2009 and 31/03/2015 with a diagnosis of pneumothorax were extracted from the reports on radiological electronic database. We then reviewed their management and outcomes as documented on the electronic BadgerNet patient record database.

## RESULTS

During this period 201 babies were identified with a pneumothorax on their chest X-ray reports.

114 were born preterm < 37 weeks gestation. 147 were ventilated or on non-invasive support at the time and 54 were spontaneous. The majority of pneumothoraces occurred in the first 3 days of life. Difference between preterm and term population is shown in **Tab. 1**.

**Table 1 (ABS 90).** Difference between preterm and term neonates included in the study.

| | Preterm | Term |
|---|---|---|
| **Total, n** | 114 | 87 |
| **Ventilated at the time, n** | 97 | 50 |
| **Spontaneous, n** | 17 | 37 |
| **Chest drain, n** | 82 | 26 |
| **Died, n** | 39 | 11 |
| **Discharged, n** | 75 | 76 |

## CONCLUSIONS

The number of pneumothoraces in ventilated babies has not significantly changed over the years in our neonatal unit. Spontaneous pneumothoraces can be managed conservatively as long as they were not compromised cardiovascularly. Pneumothorax remains a significant cause of morbidity and mortality among extremely preterm babies on a neonatal unit.

## ABS 91

## CLINICAL IMPACT OF THE RESPIRATORY SYNCYTIAL VIRUS INFECTION IN INFANTS WITH A HISTORY OF PREMATURITY BETWEEN 32-34 WEEKS

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## INTRODUCTION

Respiratory Syncytial Virus (RSV) is a ubiquitous virus that affects both children and adults and has a high rate of infection. It's known that RSV infection is more severe in preterm infants. In our community, apart from immunoprophylaxis under established indications, there is no specific protocol for the prevention of RSV infection in preterm infants born between 32-34 weeks.

## METHODS

To analyze in our community the clinical impact of RSV infection in preterm infants born between 32-34 weeks during the first year of life. We retrospectively recorded all newborns in our hospital with 32-34 weeks of age, during the years 2011-2015 and collected clinical variables of infants under one year admitted with RSV infection in the pediatrics epidemic stations. Data were analyzed comparing patients with a gestational age between 32-34 weeks, with those of 35 weeks gestational age or older.

## RESULTS

380 children were admitted, 18 of them (4.6%) belonged to the group from 32 to 34 weeks. These premature infants accounted for the 8.5% of all the premature infants born between 32 to 34 weeks. The clinical manifestation was bronchiolitis (82.9%), bronchospasm (2.3%), pneumonia (5.6%), apnea (2.8%) and upper respiratory tract infection (6.4%), without significant differences between groups. Neither community/nosocomial onset, nor previous pathology, comorbidities, antibiotics or oxygen administration were statically relevant. The number of admissions to an ICU in the group of 32-34 weeks was superior (35.7% vs 11.3%, p = 0.019) and also had more breathing support (42.9% vs 11.8%, p = 0.05). In this group, the duration of breathing support was longer (2.5 vs 0.7 days, p = 0.001), as well as the length of oxygen therapy (5.8 vs 4 days, p = 0.015) and length of hospital stay (8.6 vs 6.4 days, p = 0.039).

## CONCLUSIONS

In this group of children, the infection is more serious and they present a more torpid evolution.

Despite not having a very high percentage of income from RSV infection in this group of children, due to the more serious infection, it would be advisable to develop a prevention guide, coordinated with Primary Care and Public Health, based on the awareness and incorporation of hygienic measures in the community.

## ABS 92

## VOLUME CONTROLLED OR VOLUME GUARANTEE VENTILATION IN PRETERM INFANTS: A RANDOMISED CONTROLLED TRIAL

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### INTRODUCTION

Volume-targeted ventilation (VTV) leads to improved short term neonatal clinical outcomes, including death and chronic lung disease (CLD) compared with pressure-limited ventilation. However different modes of VTV have not been compared using clinically relevant outcomes. The aim of this study was to determine whether preterm infants with respiratory distress syndrome (RDS) are ready for extubation faster using volume guarantee (VG) compared to volume-controlled ventilation (VCV). We undertook a randomised controlled trial in a tertiary neonatal unit in the UK (The VoluVent Trial, ISRCTN no. 04448562).

### METHODS

Infants were eligible if (i) born at < 34 weeks' gestation (w), (ii) received surfactant and ventilation within 24 hours of birth for RDS, (iii) parental consent obtained. The primary outcome was an objective measure representing readiness for extubation. It was defined as the duration of time in hours from starting the allocated mode until reaching pre-determined "success" criteria (maintenance of a mean airway pressure < 8 $cmH_2O$ and $FiO_2 \leq 0.35$ for six consecutive hours followed by a successful spontaneous breathing test). Initial sample size calculation showed that 112 infants were needed to show a 33% reduction in time to "success" criteria using VG (80% power). Data were analysed by intention-to-treat using Kaplan-Meier "survival" probabilities, hazard ratios (HR) and odds ratios (OR).

**Table 1 (ABS 92).** Differences between volume-controlled ventilation (VCV) and volume guarantee (VG) in time to 'success' criteria or in duration of ventilation.

| | VCV n = 57 | VG n = 55 | HR (95% CI) |
|---|---|---|---|
| **Time to success criteria, hours, median (95% CI)** | 36 (18.03-53.97) | 23 (10.8-35.2) | 0.93 (0.63-1.37) |
| **Duration of ventilation before extubation, hours, median (95% CI)** | 41 (15.68-66.32) | 32 (12.53-51.47) | 0.85 (0.56-1.27) |
| **Infants reaching success criteria by 48 h, n** | 33 | 34 | N/A |

VCV: volume-controlled ventilation; VG: volume guarantee; HR: hazard ratios.

### RESULTS

113 infants were enrolled although one was subsequently withdrawn due to a postnatal diagnosis consistent with the ineligibility criteria. 112 infants were followed to death or discharge. Mean GA and median birth weight were similar between groups (VCV group: 27 w and 1,080 g, VG group: 27 w and 1,020 g). Respiratory status at trial entry was comparable between groups. The median time to "success" criteria was shorter in the VG group but this did not reach statistical significance (**Tab. 1**). No significant differences in duration of ventilation or in important secondary outcomes were seen. However the primary outcome data were not normally distributed. A post hoc sample size calculation using non-parametric tests indicates that a larger study is needed.

### CONCLUSIONS

In preterm infants with RDS there was no significant difference between VCV and VG in time to "success" criteria or in duration of ventilation. Secondary outcome measures were similar irrespective of trial mode. A larger trial may produce definitive results.

## ABS 93

## LATE PRETERM INFANTS: WHAT IS THEIR REAL RESPIRATORY MORBIDITY?

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INTRODUCTION

Morbi-mortality in late preterm infants (LPI) is higher than in term infants. In the last years, improvement in attendance has reduced hospital admissions and the need for interventions in these patients. The aim of this study is to describe the respiratory morbidity and the need for admission in LPI in a third level hospital in the last 28 months.

METHODS

Descriptive, observational, retrospective study including LPI ($34^{+0}$ to $36^{+6}$ gestational weeks) born between January 2015 and April 2017. The registered variables were: gestational age (GA), weight at birth, lung maturation, delivery type and resuscitation, the need for respiratory support and the type of this support, severity of respiratory distress (RD), admission in the unit and length of the admission, development of bronchopulmonary dysplasia and death. Analysis of data using SPSS®, using non-parametric tests (U Man Whitney, Chi Square and ANOVA tests) with significance level $p < 0.05$.

RESULTS

440 LPI (5.14% of total of newborns in the same period) were included, of which 73 (16.5%) of 34 GA, 134 (30.5%) of 35 GA and 233 (53%) of 36 GA. Only 5% of LPI in 34 GA group did not require admission to Neonatal Unit, and 75% did not need respiratory support. In 35 GA group, the percentages were 45.5% and 79% for the same variables, and in 36 GA group, 79.6% and 95% respectively ($p < 0.05$). 15% of 34 GA were admitted to NICU. The severity of RD is greater in cesarean group (severe RD 12.5% vs 3.6% in vaginal group; $p = 0.00$), in 34 GA LPI without antenatal corticosteroids (severe RD in 5% with correct lung maturation vs 19.5% without $p = 0.19$). Subgroup of 35 GA had more severe DR (12% vs 11% in 34 GA $p = 0.432$; vs 2.6% in 36 GA $p = 0.00$); 94% of 35 GA did not receive antenatal corticosteroids, compared to 56% who did receive that in 34 GA group.

CONCLUSIONS

LPI are a group of risk of DR and other complications that require hospital admission. The results in our study differ in some aspects from those published in the current literature, such as incidence of RD (greater in our study) or NICU admission (lower). The highest percentage of severe RD in LPI without correct lung maturation supports the recently published recommendations of expanding the use of antenatal corticosteroids to this group.

**ABS 94**

## REVIEW OF OUTCOMES IN PRETERM NEONATES FOLLOWING CHANGE OF VENTILATORY PRACTICE TO VOLUME-TARGETED VENTILATION IN A NEONATAL INTENSIVE CARE UNIT

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INTRODUCTION

Chronic lung disease (CLD) defined as oxygen requirement at 36 weeks corrected gestation is one of the major morbidities of prematurity. As survival improves, improving care and outcomes gains increasing importance. We evaluated neonatal outcomes in CLD in a UK neonatal intensive care unit with approximately 1,500 admissions per year, following the introduction of a unit-wide strategy to routinely use volume-targeted ventilation (VTV) instead of pressure-limited ventilation.

METHODS

Information on demographics, antenatal, postnatal care and outcomes was collected using the BadgerNet neonatal electronic database in all inborn babies with CLD, defined as oxygen requirement at 36 weeks corrected gestation. The two study periods were: 1st April 2012 - 31st March 2014 (pre change to VTV) and 1st April 2014 - 31st March 2016 (post change to VTV).

RESULTS

There were 77 patients in 2012-2014 and 71 in 2014-2016. There were no significant differences in the epidemiological factors, length of stay or administration of antenatal or postnatal steroids, or diuretics during the two study periods. Surfactant was given to more babies in 2014-2016 (83% vs 96%, p 0.01). Overall, there was a significant reduction in requirement for any respiratory support (96 vs 79 median days, $p = 0.0002$) and half the number of infants (49% vs 25%, $p = 0.003$) were discharged with home oxygen in those managed with VTV. Results are presented in **Tab. 1**.

CONCLUSIONS

Our study supports the growing evidence in literature in favour of use of VTV mode of ventilation in preterm neonates to improve respiratory outcomes. The improved outcomes for home oxygen use are of long-term benefit for babies, families and the health service.

**Table 1 (ABS 94).** Results in the 2 different periods.

| | 2012-2014 | 2014-2016 | p-value |
|---|---|---|---|
| **Total admissions < 32 weeks** | 393 | 395 | |
| **Number with CLD** | 77 | 71 | 0.63 |
| **F:M** | 1:1.7 | 1:1.6 | 0.96 |
| **Gestation (wks), median (range)** | 26 (23-32) | 27 (23-33) | 0.3 |
| **BW (g), median (range)** | 806 (453-1,790) | 800 (475-1,780) | 0.23 |
| **Surfactant administration** | 64 (83%) | 68 (96%) | 0.01 [a] |
| **Length of stay, median (range)** | 102 (49-207) | 100 (37-207) | 0.21 |
| **Vent. days, median (range)** | 15 (0-87) | 14 (0-95) | 0.5 |
| **CPAP days, median (range)** | 39 (1-97) | 13 (0-68) | < 0.00001 [a] |
| **$O_2$ days, median (range)** | 39 (0-159) | 43 (11-111) | 0.15 |
| **Total resp. support, median (range)** | 96 (14-256) | 79 (19-207) | 0.0002 [a] |
| **Pneumothorax** | 6 | 7 | 0.66 |
| **Discharged home** | 34 (44%) | 39 (55%) | 0.19 |
| **Discharged home in oxygen** | 38 (49%) | 18 (25%) | 0.003 [a] |
| **Died > 36 weeks** | 1 (1%) | 4 (6%) | 0.14 |
| **Transferred to other hospital/paeds** | 4 (5%) | 10 (14%) | 0.68 |

[a] $p < 0.05$.
CLD: chronic lung disease.

## ABS 95

## OXYGEN SATURATION TRENDS IN LATE PRETERM INFANTS

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### INTRODUCTION

Late preterm infants (LP: $34^{+0}$-$36^{+6}$ weeks' gestational age [GA]) constitute 6% of all infants born annually. LP infants have higher mortality and morbidity rates, and are at higher risk of neurodevelopmental impairment, than infants born at term. Several retrospective studies have demonstrated that LP infants have increased neonatal respiratory morbidity compared to term infants. However, it is unknown if LP infants have lower oxygen saturations ($SpO_2$) in the weeks after birth. Our aim was to determine $SpO_2$ in LP infants compared with term infants from after birth to 5 weeks' corrected age.

### METHODS

Prospective cohort observational study at Auckland City Hospital. LP infants and the next term infant ($39^{+0}$-$41^{+6}$ weeks' GA) born by the same mode of delivery were recruited. Infants were eligible if they no longer needed respiratory support by 48 hours after birth and did not have a major congenital abnormality. Overnight pulse oximetry (Masimo Radical-7®) was performed on day 2-3 after birth, 40 weeks' GA (LP) and at 5 weeks' corrected age and edited with Profox oximetry software to remove data with poor signal. Data were analysed by general mixed model run separately for postnatal age (PNA, birth vs 5 weeks') and GA (40 weeks' vs 45 weeks'). Data were categorised ($25^{th}$ percentile): mean $SpO_2$ (≥ 97.5% or < 97.5%) and time spent.

### RESULTS

43 LP and 42 term infants were enrolled. GA was lower in LP infants (mean [SEM], GA: 35.4 [0.1] vs 40.1 [0.1] weeks, $p < 0.0001$). Overall, the mean $SpO_2$ was 97.8% (96.9%-98.6%) at birth and 99.0% (98.6%-99.5%) at 5 weeks PNA. On PNA analysis, LP infants had a lower reduction of proportion with a mean $SpO_2$ < 97.5% from birth to 5 weeks' PNA (least squares mean [95% CI], birth: LP 0.30 [0.12-0.48] vs term 0.41 [0.26-0.59]; 5 weeks' PNA: LP 0.21 [0.09-0.40] vs term 0.03 [0.00-0.21]; $p = 0.05$). Time spent < 90% $SpO_2$ decreased with PNA (OR [95% CI], 3.7 [1.5-9.1], $p < 0.005$). On GA analysis, LP had a lower proportion of mean $SpO_2$ < 97.5% (LP vs term, OR [95% CI]: 0.32 [0.11-0.94], $p < 0.05$) and a lower proportion of time < 90% $SpO_2$ (LP vs term, OR [95% CI]: 0.32 [0.15-0.79], $p < 0.005$). There was an increase in mean $SpO_2$ with GA (40 weeks' GA

vs 45 weeks' GA, OR [95% CI]: 16.3 [1.9-141.4], p = 0.01).

CONCLUSIONS

$SpO_2$ increased with age in the first 1-2 months after birth in both LP and term infants. However, LP infants were slower to increase their $SpO_2$ after birth than term infants. LP infants had higher $SpO_2$ than term infants at term corrected age, due to a longer exposure to the postnatal environment. Further research is needed to determine the effect of these changes in oxygen saturation in LP infants on their neurodevelopmental outcome.

## ABS 96

## INHALED NITRIC OXIDE IMPROVES SURVIVAL IN PRETERM INFANTS DIAGNOSED WITH PULMONARY HYPOPLASIA

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**Table 1 (ABS 96).** Clinical and demographic characteristics.

| | Full cohort | | p-value | Propensity matched (1:1) cohort | | p-value |
|---|---|---|---|---|---|---|
| | No iNO Treatment (n = 809) | iNO Treatment (n = 264) | | No iNO Treatment (n = 175) | iNO Treatment (n = 175) | |
| **Gestational age (weeks)** | | | 0.004 | | | 0.9872 |
| **Mean (SD)** | 26.3 (1.8) | 26.9 (1.6) | | 26.7 (1.8) | 26.7 (1.6) | |
| **Median (IQR)** | 26.0 (25.0, 28.0) | 27.0 (26.0, 28.0) | | 27.0 (25.0, 28.0) | 27.0 (25.0, 28.0) | |
| **Birth weight** | | | < 0.0001 | | | 0.3938 |
| **Mean (SD)** | 0.9 (0.3) | 1.0 (0.3) | | 1.0 (0.3) | 1.0 (0.3) | |
| **Median (IQR)** | 0.9 (0.7, 1.1) | 1.0 (0.8, 1.3) | | 0.9 (0.8, 1.2) | 1.0 (0.8, 1.2) | |
| **Sex** | | | 0.3701 | | | 0.8348 |
| **Female** | 333 (41.2%) | 119 (45.1%) | | 82 (46.9%) | 81 (46.3%) | |
| **Male** | 468 (57.8%) | 144 (54.5%) | | 91 (52.0%) | 93 (53.1%) | |
| **Unknown** | 8 (1.0%) | 1 (0.4%) | | 2 (1.1%) | 1 (0.6%) | |
| **Inborn or outborn** | | | 0.0139 | | | 0.8356 |
| **Inborn** | 762 (94.2%) | 237 (89.8%) | | 162 (92.6%) | 163 (93.1%) | |
| **Outborn** | 47 (5.8%) | 27 (10.2%) | | 13 (7.4%) | 12 (6.9%) | |
| **Discharge year** | | | < 0.0001 | | | 0.7975 |
| **2000-2002** | 130 (16.1%) | 12 (4.5%) | | 17 (9.7%) | 12 (6.9%) | |
| **2003-2005** | 186 (23.0%) | 37 (14.0%) | | 38 (21.7%) | 36 (20.6%) | |
| **2006-2008** | 181 (22.4%) | 50 (18.9%) | | 34 (19.4%) | 41 (23.4%) | |
| **2009-2011** | 148 (18.3%) | 85 (32.2%) | | 41 (23.4%) | 43 (24.6%) | |
| **2012-2014** | 164 (20.3%) | 80 (30.3%) | | 45 (25.7%) | 43 (24.6%) | |
| **Race** | | | 0.4283 | | | 0.8319 |
| **Asian** | 20 (2.5%) | 4 (1.5%) | | 6 (3.4%) | 4 (2.3%) | |
| **Black** | 166 (20.5%) | 51 (19.3%) | | 34 (19.4%) | 28 (16.0%) | |
| **Hispanic** | 127 (15.7%) | 47 (17.8%) | | 30 (17.1%) | 30 (17.1%) | |
| **Other** | 49 ( 6.1%) | 23 (8.7%) | | 11 (6.3%) | 14 (8.0%) | |
| **White** | 447 (55.3%) | 139 (52.7%) | | 94 (53.7%) | 99 (56.6%) | |
| **Max respiratory support** | | | < 0.0001 | | | 0.3060 |
| **Room air** | 12 (1.5%) | 0 (0.0%) | | 0 (0.0%) | 0 (0.0%) | |
| **Nasal cannula** | 1 (0.1%) | 0 (0.0%) | | 0 (0.0%) | 0 (0.0%) | |
| **Nasal CPAP** | 6 (0.7%) | 0 (0.0%) | | 0 (0.0%) | 0 (0.0%) | |
| **CMV** | 161 (19.9%) | 10 (3.8) | | 6 (3.4%) | 10 (5.7%) | |
| **HFOV** | 627 (77.5%) | 253 (95.8%) | | 169 (96.6%) | 165 (94.3%) | |
| **Unknown** | 2 (0.2%) | 1 (0.4%) | | | | |
| **Antenatal steroids given** | 638 (78.9%) | 237 (89.8%) | 0.0001 | 149 (85.1%) | 153 (87.4%) | 0.5342 |
| **Prolonged ROM reported** | 386 (47.7%) | 134 (50.8%) | 0.3901 | 87 (49.7%) | 83 (47.4%) | 0.6688 |
| **Oligohydramnios reported** | 110 (13.6%) | 19 (7.2%) | 0.0055 | 24 (13.7%) | 17 (9.7%) | 0.2446 |
| **Surfactant given** | 636 (78.6%) | 246 (93.2%) | < 0.0001 | 161 (92.0%) | 158 (90.3%) | 0.5725 |
| **Vasopressor reported** | 412 (50.9%) | 213 (80.7%) | < 0.0001 | 135 (77.1%) | 130 (74.3%) | 0.5331 |
| **PPHN reported** | 143 (17.7%) | 198 (75.0%) | < 0.0001 | 110 (62.3%) | 109 (62.3%) | 0.9121 |

CMV: conventional mechanical ventilation; HFOV: high frequency oscillatory ventilation; ROM: rupture of membranes.

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INTRODUCTION
Pulmonary hypoplasia (PH) often occurs secondary to another abnormality of fetal development and may present as hypoxemic respiratory failure with or without persistent pulmonary hypertension (PPHN). Given the especially high mortality rate among preterm neonates with PH, inhaled nitric oxide (iNO) is often used as rescue therapy despite limited evidence regarding its effectiveness in the preterm population overall. Given the barriers to conducting large clinical trials to assess the effects of iNO in preterm neonates with PH, alternate study designs are needed. We conducted this study to test the hypothesis that iNO therapy is associated with improved survival in preterm infants with PH.
METHODS
We performed a retrospective cohort subset analysis by querying the Pediatrix Medical Group Clinical Data Warehouse to identify all neonates born at 22-29 weeks gestation during the years 2000-2014. Only those diagnosed with PH were included and we excluded those with major anomalies. From this sample, we developed two treatment cohorts: those who received iNO during the first seven days of life and those who did not (controls). One-to-one propensity score-matching without replacement was performed to build two cohorts of matched patients. The primary outcome was mortality (defined as death prior to discharge). Secondary outcomes included any-stage necrotizing enterocolitis, retinopathy of prematurity requiring treatment, and chronic lung disease.
RESULTS
Among 88,169 neonates born at 22-29 weeks gestation, we identified 1,073 (1.2%) who were diagnosed with PH and no major anomalies. The demographic and clinical characteristics of each cohort are shown (**Tab. 1**). In this full cohort, patients who received iNO were slightly larger and more mature; were more often diagnosed with PPHN; and received a higher level of respiratory and vasopressor support. From the full cohort we derived two matched cohorts of 175 patients each. The distribution of all observed covariates was similar in each cohort, including antenatal steroid exposure, surfactant administration, high rates of PPHN, high frequency oscillation and vasopressor use. Patients who did not receive iNO therapy had higher mortality (63% vs. 47%; OR 1.87; 95% CI 1.22 to 2.87; $p < 0.01$). There were no statistically significant differences in secondary outcomes between the matched cohorts.
CONCLUSIONS
Preterm neonates diagnosed with PH have high rates of mortality and morbidity. This is the first large study to demonstrate that treatment with iNO is associated with improved survival in preterm neonates with PH. Preterm infants diagnosed with PH may represent a specific preterm subpopulation to derive a survival benefit from the selective use of iNO. Large prospective (randomized control) trials are needed to confirm these observations.

## ABS 97

## NORMALISATION OF PULMONARY GAS EXCHANGE CAPACITY IN VERY PRETERM INFANTS FOLLOWING INITIAL HOSPITAL DISCHARGE DEFINED BY SHIFT OF THE $SPO_2$-$PIO_2$ CURVE

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INTRODUCTION
The NICHD definition of bronchopulmonary dysplasia (BPD) provides a categorical quantification of BPD severity but is influenced by oxygen prescribing policies. The Walsh physiological test standardises BPD assessment but classifies infants with mild BPD as healthy. Neither approach adjusts for altitude. Non-invasive measurement of the rightward "shift" of the peripheral oxyhaemoglobin saturation/pressure of inspired oxygen ($SpO_2$-$PIO_2$) curve provides a continuous measure of pulmonary gas exchange in preterm infants with BPD, adjusted for altitude. We examined whether shift identifies longitudinal improvements in pulmonary gas exchange in very preterm infants (< 32 w gestational age; GA).
METHODS
Shift was measured using the dynamic oxygen test in 9 very preterm infants at 36 w and 44 w postmenstrual age (PMA) in supine position. $PIO_2$

(kPa) equals inspired oxygen percentage at sea level. $PIO_2$ was reduced stepwise as required to achieve preductal $SpO_2$ between 99-88%. Maximum and minimum $PIO_2$ required were 30 kPa and 14 kPa respectively. Sequential paired measurements of $PIO_2$-$SpO_2$ were analysed to calculate the shift using a computer algorithm. Additionally, shift was measured in 16 healthy term infants ($39^{+0}$-$41^{+6}$ w GA) at 44 w PMA for comparison against the preterm infants at a common maturational age. In term infants $PIO_2$ was reduced from 21 kPa to 14 kPa.

RESULTS

Shift in very preterm infants decreased between 36 w and 44 w PMA (12.3 ± 4.2 kPa vs. 7.3 ± 2.1 kPa, p = 0.001). There was a strong negative correlation between absolute reduction in shift between 36 w and 44 w PMA and shift at 36 w PMA ($R^2$ = 0.87, p < 0.001; see **Fig. 1**). GA was an independent predictor of shift in very preterm infants at 44 w PMA ($R^2$ = 0.52, p = 0.02). Shift was not different in very preterm (7.3 ± 2.1 kPa) and term infants (5.9 ± 1.3 kPa) at 44 w PMA (mean difference [95% CI]: 1.32 [-0.06, 2.70] kPa; p = 0.06). Term infants had comparable shift values to the reported healthy adult values (adults 6 kPa, p = 0.87).

CONCLUSIONS

Shift detects improvements in the pulmonary gas exchange capacity of very preterm infants with postnatal lung development. More rapid improvement in shift in very preterm infants with severe initial gas exchange impairments may indicate catch-up alveolarisation. A delay in alveolarisation is suggested as a potential alternative to the current concept of arrested alveolarisation.

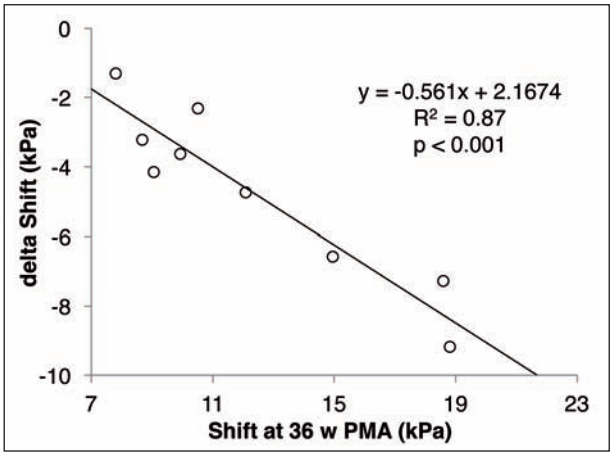


**Figure 1 (ABS 97).** Negative linear correlation between delta shift (44 w - 36 w PMA) and shift at 36 w PMA and (kPa).

FUNDING

NHMRC GRT1047689, 1057514, 1077691, SNF P2BSP3_158837.

## ABS 98

## SIMPLIFIED AUSTRALIAN AND NEW ZEALAND NEONATAL NETWORK (ANZNN) SHIFT TEST ACCURATELY PREDICTS RIGHTWARD SHIFT OF THE $SPO_2$-$PIO_2$ CURVE IN AN EXTREMELY PRETERM INFANT POPULATION

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INTRODUCTION

Assessment of the rightward shift of the peripheral oxyhaemoglobin saturation – pressure of inspired oxygen ($SpO_2$-$PIO_2$) curve provides a continuous outcome measure of pulmonary gas exchange impairment in preterm infants with bronchopulmonary dysplasia (BPD). The Australian and New Zealand Neonatal Network (ANZNN) introduced a 15-min spot test of $SpO_2$-$PIO_2$ (modified Jones test) as a routine clinical assessment of shift in extremely preterm infants (< 28 w gestational age; GA). We validated the ANZNN shift test against the gold standard dynamic oxygen test to identify whether the ANZNN test was a reliable assessor of shift in extremely preterm infants.

METHODS

Shift was measured non-invasively in 36 extremely preterm infants at 36 w postmenstrual age (PMA). $PIO_2$ (kPa) equals inspired oxygen percentage at sea level. During the ANZNN shift test, mean $O_2$ concentration required to maintain $SpO_2$ at 90-94% was recorded over 15 minutes. Shift was then determined from the single paired $SpO_2$-$PIO_2$ measurement using a validated table. The dynamic oxygen test involved stepwise reduction of $PIO_2$ as required to achieve preductal $SpO_2$ between 99-88%. Shift was calculated from sequential paired $SpO_2$-$PIO_2$ measurements using a computer algorithm. The agreement between the ANZNN shift test and the dynamic oxygen test was assessed using a Bland-Altman plot.

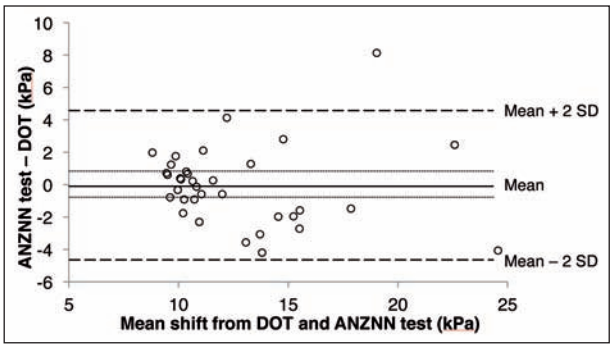


**Figure 1 (ABS 98).** Bland-Altman plot showing agreement between the ANZNN test and dynamic oxygen test (DOT).

RESULTS

The median (IQR) shift in extremely preterm infants was not different between the ANZNN shift test (10.8 [3.8] kPa) and the dynamic oxygen test (11.1 [5.2] kPa). The mean difference (95% CI) for ANZNN shift – dynamic oxygen test shift was -0.06 (-0.87, 0.75) kPa (**Fig. 1**). However, the ± 2 SD limits of agreements were from -4.8 kPa to 4.6 kPa.

CONCLUSIONS

The 15-min ANZNN shift test is a useful tool for benchmarking of respiratory outcomes at the population level, with potential utility for comparisons of BPD outcomes across different neonatal units and in large randomised clinical trials. At an individual level the test result can be used as a screening tool to identify infants requiring more in-depth assessment of pulmonary gas exchange.

FUNDING

NHMRC 1047689,1057514,1077691, SNF P2BSP3_158837.

## ABS 99

## CORRELATION BETWEEN BODY TEMPERATURE AND CEREBRAL OXYGENATION IN NEONATES DURING TRANSITION AFTER BIRTH

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INTRODUCTION

Morbidity and mortality of neonates immediately after birth are closely related to body temperature and cerebral tissue oxygenation ($crSO_2$). Yet, there is scarce data on dependency between these two parameters. Thus, the primary aim of the present study was to investigate the correlation between body temperature and $crSO_2$ in neonates during immediate transition after birth. The secondary aim was to compare body temperature and $crSO_2$ between preterm and term neonates.

METHODS

Data were obtained as exploratory parameters of prospective observational studies in preterm and term neonates after delivery by caesarean section. We included neonates in whom i) cerebral near-infrared spectroscopy (NIRS) measurements were performed during immediate transition after birth and ii) body temperature was measured rectally 15 minutes after birth (degrees Celsius = °C).

Data are given as medians (range) based on distribution. To investigate potential associations, body temperature and $crSO_2$ 15 minutes after birth were correlated. We used non-parametric tests (Mann-Whitney-U, Spearman's correlation) for data analyses and correlations (IBM® SPSS® Statistics 22), with $p < 0.05$ being considered statistically significant.

RESULTS

Data of 586 neonates – including 164 preterm neonates (28.0%) – with a median gestational age of 38.6 weeks (23.8-41.4) were analysed. Median body temperature was 36.8°C (35.0-39.0), with 461/586 neonates (78.7%) being normothermic (i.e. 36.5-37.5°C). Median $crSO_2$ was 78.8% (15.9-95.0) 15 minutes after birth. There was no significant correlation between body temperature and $crSO_2$ neither for the whole group ($\varrho = 0.011$, $p = 0.816$) nor for preterm ($\varrho = -0.071$, $p = 0.446$) or term neonates ($\varrho = 0.054$, $p = 0.316$). Body temperature was significantly lower in preterm neonates (mean difference 0.1°C, $p = 0.003$) compared to term neonates, while $crSO_2$ did not differ between groups ($p = 0.689$).

CONCLUSIONS

There was no correlation between body temperature and $crSO_2$ in preterm and term neonates during immediate transition after birth. Body temperature was within recommended range in almost 80% of included neonates, whereas observed variations in body temperature underline the challenge of maintaining normothermia.

## ABS 100

## A NEONATAL RESUSCITATION ALGORITHM FOR MID-TO-LOW RESOURCE SETTINGS IN MÉDECINS SANS FRONTIÈRES' PROGRAMS

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INTRODUCTION

The experience of Médecins Sans Frontières (MSF) in providing neonatal care in resource-limited settings has highlighted the urgent need for an advanced resuscitation protocol as the 'next step' beyond Helping Babies Breathe (HBB). Particularly, MSF's programs may be able to provide more intervention than HBB, but less than what is recommended by the International Liaison Committee on Resuscitation (ILCOR) or by the European Resuscitation Council (ERC) algorithms. To prevent individual adaptation to field situations, which lead to wide practice variation, a unified protocol for delivery room management, which would also applicable to any situation of neonatal respiratory failure was sought.

METHODS

An independent committee of international experts was formed June 2016 to establish consensus on an algorithm to guide practice in more advanced resuscitation, adapted for MSF. Initial discussions centered on existing algorithms for high and low-resource settings, based on the ILCOR algorithm and well-known HBB algorithm respectively, which were then contrasted with the needs of MSF programs. The committee then focused on the necessary elements for a mid-to low-resource setting algorithm, such as when to check heart rate; when/if to suction for meconium; how/when to evaluate and treat hypoxaemia; and provision of chest compressions and emergency drugs. Algorithm drafts evolved to the final product through committee deliberations and input from MSF field teams and medical department.

RESULTS

The algorithm incorporated key decisions to highlight thermoregulation; to avoid steps that would delay starting ventilation; to give general guidance for oxygen use when pulse oximeters are available; to include chest compressions and emergency drugs; to include when to stop resuscitation; and to highlight team communication. By March 2017 there was agreement on the content and design of the novel, single-page algorithm, which was submitted to MSF's paediatric working group for feedback and approval. The algorithm was accepted and will be included in the first edition of MSF's international neonatal guidelines, to be published in 2018.

CONCLUSIONS

An expert consensus panel was able to design a unique clinical tool that aims to fill a gap in the provision of neonatal care in mid-to-low resource, MSF settings. Next steps are implementation and development of the training program to teach the algorithm to MSF's field teams, starting in 2017.

## ABS 101

## NASAL HIGH-FLOW THERAPY AS PRIMARY RESPIRATORY SUPPORT FOR PRETERM INFANTS WITHOUT USE OF NASAL CONTINUOUS POSITIVE AIRWAYS PRESSURE

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INTRODUCTION

Bronchopulmonary dysplasia (BPD), main respiratory complication of prematurity, is thought to be related to injury caused by mechanical ventilation. Nasal continuous positive airway pressure (nCPAP) has been used as the non-invasive respiratory support in treatment of respiratory distress syndrome (RDS), although it causes significant nasal trauma. Nasal high-flow therapy (nHFT) is an alternative, better-tolerated form of non-invasive respiratory support and large trials have shown that these two forms have similar success in preventing extubation failure. Recent RCT suggested that nHFT might be inferior to nCPAP in preventing intubation, and that some babies need to be "rescued" with CPAP.

METHODS

To evaluate the effectiveness of nHFT as a primary respiratory support for preterm infants with RDS, a retrospective observational study was performed in

two tertiary neonatal units in the UK, John Radcliffe Hospital (JRH), Oxford, and St Peter's Hospital (SPH), Surrey, that use predominantly nHFT. LISA (less invasive surfactant administration) was only available at SPH. Infants born between May 2013 and June 2015 were included if they met the following inclusion criteria: Inborn; between 28 and $36^{+6}$ weeks of gestation (GA), less than 24 hours old at the start of nHFT, having received no previous endotracheal ventilation. Total of 381 infants, 191 from JRH and 190 from SPH were analysed. Comparisons were performed by the appropriate statistical tests.

RESULTS

There were no differences between JRH and SPH in the use of antenatal steroids, caesarean section, PPROM, male sex and multiple births. Mean birth weight and mean GA differed between JRH and SPH (2,019 g vs 1,770 g, $p < 0.001$) and (32.9 w vs 32.3 w, p 0.01) respectively, but not the proportion of babies born below 32 weeks GA (36.1% vs 43.7%, p 0.13). Intubation rates, acc. to pre-specified criteria, were comparable (14.7% JRH vs 11.1% SPH, p 0.29). There were significative differences in intubation rates according to gestational age (26% JRH vs 16.9% SPH, $p < 0.001$ for babies < 32 weeks GA, and 8.2% JRH vs 6.5% SPH, for babies ≥ 32 weeks GA). Eleven babies at SPH were given surfactant via LISA. There were no differences in mortality, BPD or duration of oxygen. There were no differences in adverse neonatal events (air leak, PDA, sepsis, ROP, IVH) except NEC (4.2% JRH vs 0% SPH, p 0.004).

CONCLUSIONS

1. Use of nHFT for primary respiratory support, without use of nCPAP as rescue treatment, resulted in intubation rates lower or comparable to published data.
2. At SPH, the LISA procedure reduced the rate of intubation in babies on NHFT.
3. As a new, minimally invasive approach in respiratory care of preterm infants, LISA combined with nHFT should be tested prospectively in an RCT.
4. Non-pulmonary outcomes, in particular NEC, are likely to be associated with differences in unit policy feeding regimes, etc.

## ABS 102

## DIURETICS FOR EVOLVING CHRONIC LUNG DISEASE OF PREMATURITY: WHO ARE WE TREATING?

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INTRODUCTION

Diuretics are commonly used in the management of evolving chronic lung disease (CLD) of prematurity, despite equivocal evidence of efficacy. Systematic reviews have been limited by significant heterogeneity in clinical practice between and within centres, including indication for treatment, choice, dosage and duration of treatment, and short- and long-term outcomes. We aimed to review the use and short-term respiratory outcomes of diuretics for evolving CLD in one tertiary perinatal centre.

METHODS

This retrospective audit included infants born at < 30 weeks' gestational age (GA) and/or birth weight (BW) < 1,500 g admitted to The Royal Women's Hospital NICU between January 2015 and December 2016 and treated with diuretics for ≥ 2 consecutive days. The usual diuretic regimen comprised furosemide 1 mg/kg/day for 3 days, followed by hydrochlorothiazide 2 mg/kg/day. Perinatal data were abstracted from a prospective electronic database and by chart review. CLD was defined by supplemental $O_2$ requirement at 36 weeks' postmenstrual age. Reductions in $FiO_2$ ≥ 5% or respiratory support over the duration of the diuretic course were considered to be diuretic-associated improvements. Descriptive data are presented by mean (standard deviation, SD), median (interquartile range, IQR), or proportion.

RESULTS

92 infants (47% female) were included. Mean GA was 26.6 weeks (SD ± 1.6) and mean BW 847 g (SD ± 180). 148 courses of diuretics were given (median 1 course per infant; range 1-5). 62% received 1 course of diuretics, 27% 2 courses, and 11% > 2 courses. Median postnatal age was 24 days (IQR 17-37) and mean postmenstrual age was 30.5 weeks (SD ± 2.4) at commencement of the first course of diuretics. 64% of infants were receiving non-invasive respiratory support, with 36% ventilated at commencement of diuretics. Furosemide was given in 91% of courses (median 3 days; IQR 3-4) and hydrochlorothiazide in 60% of courses (median 12 days; IQR 8-17). 54% of infants had a reduction in $FiO_2$ ≥ 5% (median 10%, IQR 7-20) and 44% of infants weaned respiratory support over the duration of the

diuretic course. 100% of infants were oxygen-dependent at 28 days and 89% had CLD at 36 weeks' postmenstrual age.

CONCLUSIONS

More than 50% of preterm infants experienced short-term improvement in respiratory status during treatment with diuretics for evolving CLD. However, the majority of preterm infants treated with diuretics were diagnosed with CLD at 36 weeks' postmenstrual age.

## ABS 103

## NEO (NEONATAL ESOPHAGEAL OBSERVATION) TUBE – A FEEDING TUBE WITH MONITORING FUNCTION

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INTRODUCTION

Preterm infants show signs of autonomic dysregulation such as apnea, bradycardia and difficulty in swallow-breath coordination. Autonomic dysregulation requires monitoring in a neonatal intensive care unit (NICU) and feeding via gastric tube for weeks. Surface electrodes are commonly used to monitor heart rate (HR) and respiratory rate (RR) in NICUs. However, their use results in movement artifacts, noise caused by skeletal muscles and frequent skin irritation. Our goal was to assess whether monitoring of HR and RR is feasible via gastric feeding tube and to compare NEO monitoring with synchronized standard monitoring data from the NICU.

METHODS

We performed a prospective single center study in the NICU at the University of Basel Children's

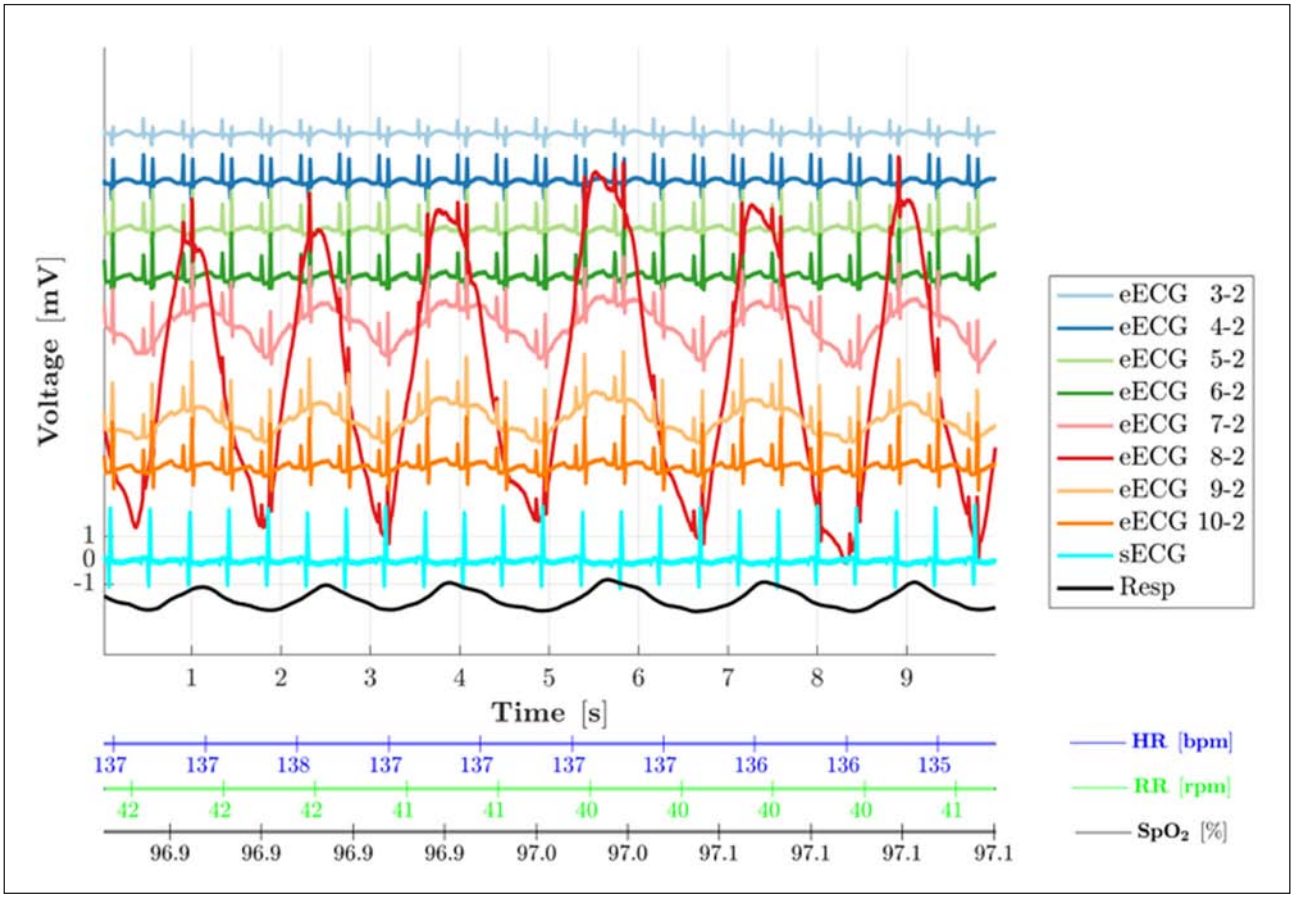


**Figure 1 (ABS 103).** An example of the well-correlated neonatal intensive care unit (NICU) data and neonatal esophageal observation (NEO) signals.

Hospital. We included preterm infants with postconceptional age > 32 weeks at the time of study. Standard feeding tubes were replaced by an Edi-tube, normally used for Neurally Adjusted Ventilatory Assist. On five consecutive days multichannel signals from the Edi-tube and standard monitoring data (extracted from Philips IntelliVue using ixTrend) were captured and synchronized with customized software. Signals were visually analyzed and for each measured hour a period of 10 minutes, in which NEO and NICU signals are of high quality, was selected. A wavelet transformation was used to detect R-peaks and the breathing cycle, both of which were subsequently used to calculate the NEO HR and RR.

RESULTS

Between July 2015 and March 2016 we performed 60 measurements in 13 preterm infants (6 male). Study participants had a mean (range) gestational age of 33.0 (28.8-35.1) weeks and mean (range) birth weight of 1,621 (970-2,340) g. No adverse events were noted. Standard monitoring data and the NEO data showed a median (IQR) difference of 0.55 (25.3) ms for HR and 118 (361) ms for RR, respectively. The difference is not significant for HR ($p = 0.053$, Wilcoxon signed rank test), but significant for RR ($p < 0.001$). An example of the well-correlated NICU data and NEO signals can be seen in **Fig. 1**. While the amplitude of the R wave in esophageal traces with high inter-electrode distances (e.g. eECG 2-10) is similar to that of the surface ECG (sECG), the low-frequency (respiration) signal is much more pronounced in selected NEO traces (e.g. eECG 8-2) compared to surface-detected respiration (Resp).

CONCLUSIONS

Extracting R peaks and respiration from an Edi-tube in preterm infants is feasible. HR derived from NEO differed only to a small, not significant amount compared to standard monitoring. Differences in RR were significant between the two signal sources. This is probably due to skeletal muscle activity causing noise in surface electrodes. We see great potential in further developing the NEO approach to improve monitoring in preterm infants.

## ABS 104

## CAN $TcPCO_2$ MONITORIZATION IN THE DELIVERY ROOM BE HELPFUL FOR DIFFERENTIATING TERM NEWBORNS IN NEED OF HOSPITALIZATION FOR RESPIRATORY MORBIDITIES?

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INTRODUCTION

It is very important, to observe and monitorize the newborn babies within the first hours of the life, while there is a complete change in cardiopulmonary adaptation during transition from intrauterine life to the external world in terms of possible respiratory morbidities. The aim of this study is, to evaluate whether there is a difference between transcutaneous partial carbon dioxide ($TcPCO_2$) levels of hospitalized babies within the first two hours of life due to respiratory distress and to evaluate the correlation of $TcPCO_2$ levels with the $PCO_2$ levels of routinely obtained capillary blood gas measurements and to correlate $TcPCO_2$ and $PCO_2$ values with clinical trends.

METHODS

In this prospectively designed study; we included all of the term infants (> $37^{0/7}$ gw) born in our hospital between November 2016 and February 2017, without perinatal asphyxia, congenital anomalies, and who were not directly hospitalized due to any cause, after parental consent was obtained. Demographic properties including prenatal and neonatal conditions were recorded in addition to immediate initialization of continuous transcutaneous (Radiometer TCM4 CombiM Monitor) and standard (Nellcor Pulse Oxymeter) monitorization of babies, right after birth until either hospitalization to NICU or keeping with the mother. On predefined intervals (15, 30, 45, 60, 90 and 120 minutes of life) babies were evaluated by a Pediatrics Resident for clinical evaluation of respiratory distress, heart rate, respiratory rate and $SaO_2$. Group 1 was composed of babies without any sign of respiratory distress. The babies with any sign of respiratory distress such as tachypnea, grunting, retractions within first 30 minutes of life were included to Group 2. Data was statistically evaluated with SPSS® v.16.0, where $p < 0.05$ was accepted for significant difference.

RESULTS

278 infants were included to the study among 556 live births during the study period. 250 (90%) of them were included to Group 1 without any signs of respiratory distress, while 28 (10%) of them consisted Group 2 due to presence of any sign

of respiratory distress. There was no difference between the groups in terms of sex, birth route, gestation weeks, birth weight, maternal properties. The groups differed for cord pH and respiratory rate on each evaluation. $TcPCO_2$ levels were higher in Group 2 on 15th and 30th minutes. Only 6 babies from Group 2 were hospitalized at the end of the 2nd hour of life. $TcPCO_2$ levels of these babies were also significantly higher from the rest of the group at 15, 30 and 45 minutes evaluations.

CONCLUSIONS

Transcutaneous monitorization of $PCO_2$ can be a useful method in addition to clinical evaluation of infants right after birth, to differentiate the infants in need of hospitalization for respiratory distress. This is the first study in the literature in which $TcPCO_2$ is used in the delivery room and early neonatal period. But as our study size was small with only 6 hospitalized babies, it was not possible to define a cut-off value for $TcPCO_2$.

## ABS 105

## HIGH FREQUENCY OSCILLATORY VENTILATION COMBINED WITH VOLUME GUARANTEE USING VERY LOW TIDAL VOLUMES TO PREVENT LUNG DAMAGE IN IMMATURE NEWBORNS

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INTRODUCTION

The pathogenesis of bronchopulmonary dysplasia (BPD) involves extreme lung immaturity due to interruption of normal gestational growth, oxygen exposure and "ventilation-induced lung injury" (VILI). High-frequency oscillatory ventilation (HFOV) was developed as a potential protective ventilation strategy. Recently, the use of increasing frequencies in order to reduce high-frequency tidal volume (VThf) when volume guarantee (VG) is used, has been proposed to improve ventilation efficacy while minimizing lung injury. The aim of the study was to evaluate the potential protective effect of HFOV combined with VG using very low tidal volume in severe respiratory distress syndrome premature infants.

METHODS

Newborn infants born less than 32 weeks of gestational age with severe respiratory insufficiency who required HFOV in the first 72 hours were retrospectively included and classified in two groups, before and after the introduction of a new lung-protective strategy in June 2014 (group 1: 2012-2013 and group 2: 2015-2016). In the second group, in which HFOV with VG was used, after adequate ventilation using standard protocol on HFOV, the VThf was fixed and the frequency was gradually increased until the highest possible. The VThf was decreased to maintain a constant $CO_2$ diffusion measurement ($DCO_2$) to keep a similar $PCO_2$. Epidemiologic and clinical features as well as the severity of BPD in both groups were analysed.

RESULTS

75 preterm infants were included, 36 in the first period and 39 in the second one. No statistically significant differences between groups in mean gestational age (26.02 vs 26.42 weeks) and mean birth weight (853.69 g vs 859 g) were found. No differences in perinatal conditions and postnatal comorbidity were detected between groups, except a trend in a higher rate of intrauterine growth restriction in the second group (2.8% vs 15.4%, p 0.06). The mean frequency achieved in the first group was 9.58 Hz (SD 1.32) vs 16.15 Hz (SD 1.41) in the second group ($p < 0.0001$) and so, it was possible to reduce mean VThf from 2.2 (SD 0.63) to 1.6 (SD 0.34) ml/kg. A trend to decrease the rate of severe BPD was detected, compared with mild and moderate BPD, in the second period (48% vs 24%, p 0.07). Mortality was similar in both groups (36.1% vs 38.5%, p 0.83).

CONCLUSIONS

Despite no statistically significant differences in severity of BPD were found when this new strategy was used, a decrease in the number of preterm infants with severe BPD was observed in the second period. It would be necessary to perform a prospective randomized study to establish the potential protective effect of this new ventilatory strategy.

## ABS 106

## MANAGEMENT OF PNEUMOTHORAX IN NEWBORNS: A NEONATAL INTENSIVE CARE UNIT EXPERIENCE IN TUNISIA

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INTRODUCTION
Neonatal pneumothorax (PTX) can occur due to underlying pulmonary disease and/or ventilatory support. Prompt diagnosis and management are essential to reduce morbidity and mortality. The aim of this study was to analyze demographic aspects, required treatment (needle aspiration or chest drain) and prognosis of neonatal PTX in an Intensive Care Unit in Tunisia.
METHODS
It is a retrospective, descriptive and analytic population-based cohort study. Inclusion criteria were neonates with symptomatic PTX, born between 1 January 2010 and 31 December 2015 and treated in the Intensive Care Unit of Monastir (Tunisia). Postoperative PTX were excluded. Needle aspiration with or without mechanical ventilation was the first line treatment. In case of failure, a chest drain was used.
RESULTS
During the study period there were 38,879 live births and 67 cases of PTX, giving an incidence of PTX of 0.17%. Of these, 19% were bilateral and 78% tension PTX. Forty nine percent of neonates affected were preterm. Fifty-eight percent of the neonates were delivered by caesarean section, 28% of which were elective. Almost all neonates had underlying lung disease, most commonly respiratory distress syndrome (RDS) in 42% and maternal fetal infection in 36%. Successful first line treatment observed in 52% was significantly correlated with gestational age ≥ 37 weeks gestation ($p = 0.002$), Silverman score ≤ 4 ($p = 0.004$), oxygen saturation ≥ 90% ($p = 0.002$) and air volume exsufflation ≤ 100 milliliters. Thirty seven percent of neonates required drainage of the PTX. Sixteen percent of PTX infants died almost because of other comorbidities.
CONCLUSIONS
Neonatal PTX can be life threatening. Less invasive treatment should be applied first in certain situations to reduce morbidity and mortality related to aggressive treatments.

**ABS 107**

## THE SAFE PROTOCOL: A SONOGRAPHIC ALGORITHM FOR LIFE-THREATENING EMERGENCIES IN THE NEONATAL INTENSIVE CARE UNIT

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INTRODUCTION
Rapid diagnosis of unexpected and potentially fatal complications in the neonatal intensive care unit (NICU), such as cardiac tamponade and tension pneumothorax, is essential to prompt and life-saving management. Multiple resuscitation protocols using point of care ultrasound (PoCUS) have been developed for adults and are widely used in emergency situations to rapidly diagnose and guide treatment, but none have so far been elaborated for critically ill neonates. This project aims to establish a simple, bedside targeted, diagnostic ultrasound algorithm for the suddenly decompensating infant in the NICU.
METHODS
The proposed algorithm was developed in a level III NICU where PoCUS is routinely performed on admission for patients with respiratory or hemodynamic compromise and in the case of sudden clinical deterioration. It is the first part of the SAFE protocol, which was awarded the 2016 ESPR Cure and Care grant. Current knowledge on the ultrasound diagnosis of the most urgent neonatal complications in the NICU was integrated into a targeted, rapid and easily performed algorithm. The protocol was evaluated at the bedside for suitability and ease of use.
RESULTS
A simple step-by-step diagnostic algorithm was designed. Main features are the use of a single probe, standardized points, and a simple rule in/rule out approach, which is suited for clinicians with basic ultrasound training. The decision tree is designed by order of urgency (**Fig. 1**). Hence, ruling out cardiac tamponade, which is a rare condition, is the first step in the decision tree since it may be rapidly fatal in the absence of prompt intervention, followed by pneumothorax, and lastly, pleural effusion. Evaluation at the bedside after basic training has shown that the algorithm is quick and easy to perform, even for less-experienced clinicians.
CONCLUSIONS
This simple diagnostic ultrasound algorithm aims to rapidly rule out the most urgent life threatening emergencies in the NICU. The simplified and rapid approach is designed for the neonatologist and is easy to learn and quick to perform. An evaluation in a multicentre study is planned.

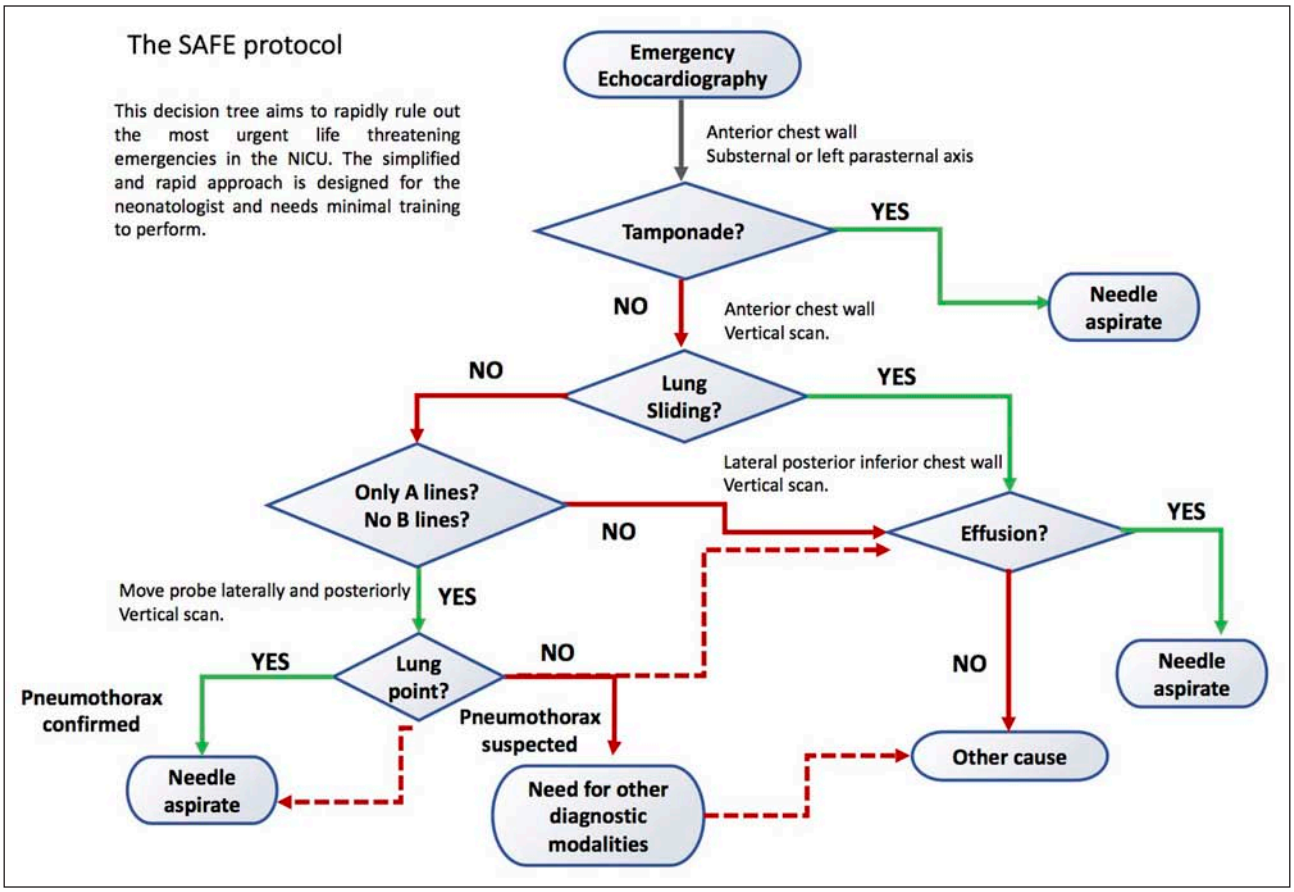


**Figure 1 (ABS 107).** The SAFE protocol: the decision tree designed by order of urgency.

DECLARATION OF INTEREST

The project was financed by the 2016 ESPR Cure and Care grant. No declared conflict of interest.

## ABS 108

## MACROLIDE THERAPY AND INCREASED PATENT DUCTUS ARTERIOSUS TREATMENT IN *UREAPLASMA*-POSITIVE PREMATURE INFANTS

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### INTRODUCTION

*Ureaplasma spp.* is likely to contribute to the development of bronchopulmonary dysplasia (BPD) in premature infants. The use of macrolide to *Ureaplasma*-positive infants to prevent BPD is still controversial and little is known about the impact on other diseases of prematurity. We aim to investigate the efficacy of macrolides for BPD and the difference in incidence of other morbidities according to treatment in very low birth weight (VLBW) infants.

### METHODS

This retrospective study was performed on VLBW infants who were able to diagnose BPD from January 2015 to December 2016. Endotracheal aspirate and gastric juice were obtained immediately after birth and tested for *Ureaplasma spp.* with culture and PCR. Therapeutic macrolides were not routinely used in *Ureaplasma*-positive infants. We analyzed the difference in incidences of BPD, necrotizing enterocolitis (NEC), intraventricular hemorrhage (IVH), patent ductus arteriosus (PDA) treatment, retinopathy of prematurity (ROP) treatment, and late-onset sepsis (LOS), according to the presence or absence of macrolide treatment.

### RESULTS

A total of 145 infants with the mean (± SD) gestational age of $28^{+5}$ (± $3^{+1}$) weeks and birth weight of 1,061.5 (± 279.2) g were included, and 31 (21.3%) were *Ureaplasma*-positive. Infants with positive *Ureaplasma spp.* (12/31, 38.7%) developed more severe BPD than negative (24/114, 21.1%) ($p = 0.044$). In the subgroup analysis for

*Ureaplasma*-positive infants, macrolides treatment (15/31, 48.3%) did not decrease the incidence of BPD (7/15, 46.7% versus 6/15, 31.3%, p = 0.379). PDA treatment with ibuprofen and/or operation was associated with the use of macrolide (p = 0.048), but NEC ≥ stage 2, IVH ≥ grade 3, ROP treatment, and LOS were not (p = 0.226, 0.394, 0.220, 0.704, respectively). After adjustment for gestational age, birth weight, and sex, PDA treatment was significantly increased with the use of macrolide (aOR 6.39; 95% CI: 1.02-40.1).

CONCLUSIONS

There was no preventive effect of macrolides for BPD in this study. VLBW infants who received macrolides tended to receive more PDA treatment. When using macrolides in *Ureaplasma*-positive VLBW infants, the hemodynamically significant change of PDA should be monitored with caution. Larger prospective studies will be needed.

## ABS 109

## MALIGNANT PERTUSSIS. IS IT TIME FOR EXCHANGE TRANSFUSION?

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INTRODUCTION

Malignant pertussis causes severe respiratory failure with difficult response to treatment. It is an important cause of infant death worldwide. Severity criteria are lung Infection with pulmonary hypertension and hyperleukocytosis. All therapeutic options should be considered. The role of exchange transfusion (ET) is controversial.

CASE REPORTS

We report two cases of malignant pertussis in neonates, treated with ET.

The first case is a male preterm newborn of $26^{+3}$ weeks of gestational age and 980 grams of birth weight. Initially he presented moderate hyaline membrane requiring mechanical ventilation for 12 hours. At 12th day of life he presented worsening general condition with onset of apneas, hypoxemia and hypotension. He was reintubated and mechanically ventilated with high frequency ventilation and received empirical antibiotic therapy. He needed vasoactive support for 9 days. Chest radiograph showed condensation in the upper right lobe and blood tests presented maximum C reactive protein of 60 mg/L and 1.16 ng/mL procalcitonin, with severe leukocytosis of up to 140,000/$mm^3$. Respiratory samples obtained by bronchoalveolar lavage showed a positive PCR to *B. pertussis*. At 17th and 18th days of life, the patient underwent exsanguinotransfusions, with normalization of white cell count. The 22nd day of life he could be extubated and two months later discharged home healthy and without neurologic or pulmonary sequelae.

The second case we report is a 16-day female neonate, born on term, without perinatal incidents, who started with cyanosis and cough after her feeds. During the next days she had increasingly respiratory difficulty, needing hospital admission for respiratory support. In the etiology study PCR to *B. pertussis* came positive. Chest radiography showed bilateral condensation. She had progressive hypotension and ventricular dysfunction, refractory to vasoactive treatment, and progressive hypoxemia resistant to ventilation therapy with conventional and HF ventilation. She needed ECMO support during 24 days. She had increasingly leukocyte count up to 77,000/$mm^3$ receiving exsanguinotransfusion in two occasions with normalization of white cell count. She received empirical antibiotics during her stay. She needed renal support therapy with hemodiafiltration. She had seizures during her ECMO treatment and a small cerebral hemorrhage was found in transfontanellar echography. She was later extubated and discharged home with anticonvulsant treatment, complete enteral feeds and without respiratory support.

CONCLUSIONS

Malignant pertussis is difficult to diagnose because it appears in newborns with unusual symptoms. Leukocytosis and condensation in chest x-ray are severity indicators. Leukoreduction seems to decrease symptoms and slow illness progression.

## ABS 110

## DELAYED CORD CLAMPING DURING RESUSCITATION – A RANDOMIZED TRIAL

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## INTRODUCTION

Delaying umbilical cord clamping for 2 to 3 minutes in term infants has been shown to improve iron stores at 4 to 6 months, to reduce anemia at 1 year and to improve fine motor function at 4 years of age. Recently, experiments on lambs have implied important effects if clamping is postponed until breathing commences, including improved cardiovascular stability. It has been hypothesized that resuscitation with an intact cord might facilitate transition and improve short as well as long term outcomes also in human infants. Studies on delayed cord clamping in infants needing resuscitation is lacking, and to our knowledge, we present data from the first randomized study on this subject.

## METHODS

Pregnant women admitted to Paropakar Maternity and Women's Hospital in Kathmandu, Nepal were randomized to have their child's umbilical cord clamped delayed (≥ 180 sec, DCC) or early (≤ 60 sec, ECC) after birth. Infants in need of resuscitation according to the "Helping Babies Breathe" protocol were included in the study. As soon as possible after birth, a pulse oximetry probe was applied on the newborns right hand. Pulse rate as well as oxygen saturation was recorded at 1, 5 and 10 minutes after birth, as well as Apgar score. Admission to the Neonatal Intensive Care Unit and mortality before discharge were also documented.

## RESULTS

Between April 13 and Aug 27, 2016, 1,560 pregnant women were randomized, and after giving birth, 122 newborns were in need of resuscitation with bag and mask; 48 randomized to ECC, 74 randomized to DCC. The rate of protocol breakage was high in the DCC group, 45 (61%) was actually resuscitated with the cord intact and are reported in this analysis. Boys were more prevalent in the 2 groups, 36 (75%) in the ECC group, 25 (56%) in the DCC group, respectively. The umbilical cord was clamped before first breath/cry in 7 (15%) of the infants in the ECC group, and in all 45 in the DCC group. Heart rate was higher in the ECC group at 1, 5 and 10 minutes, while saturation and Apgar score was higher in the DCC group (**Tab. 1**). There were no significant differences in admission to NICU; 11 (23%) vs. 4 (9%), p = 0.09 or mortality before discharge; 3 (6%) vs. 0 (0%), p = 0.24.

## CONCLUSIONS

Term infants in need of resuscitation with bag and mask were randomized before birth to umbilical cord clamping before 1 minute or after 3 minutes. Delayed cord clamping was associated with higher oxygen saturation and Apgar scores at 1, 5 and 10 minutes, while heart rate was lower at the same time points. Resuscitation with an unclamped cord was not associated with a higher admission rate to the NICU or higher pre-discharge mortality.

**Table 1 (ABS 110).** Background characteristics and outcomes on newborns resuscitated with bag and mask and randomized to early or delayed umbilical cord clamping.

| | Early < 1 min n = 48 | Delayed > 3 min only per protocol n = 45 | p-value |
|---|---|---|---|
| **Mothers age (years)** | 21.5 ± 3.3 | 23.4 ± 4.0 | 0.01 |
| **Gestational age (weeks)** | 39.7 ± 1.2 | 39.4 ± 1.4 | 0.24 |
| **Birth weight (grams)** | 3,029 ± 396 | 3,065 ± 354 | 0.65 |
| **Time to cord clamping (sec)** | 26 ± 18 | 194 ± 10 | < 0.001 |
| **Time to first breath/cry (sec)** | 52 ± 11 | 36 ± 7 | < 0.001 |
| **Pulse oximetry readings** | | | |
| **Saturation at 1 min (%)** | 62.6 ± 5.0 | 80.2 ± 3.5 | < 0.001 |
| **Saturation at 5 min (%)** | 76.1 ± 3.9 | 91.7 ± 2.7 | < 0.001 |
| **Saturation at 10 min (%)** | 85.1 ± 2.8 | 98.0 ± 1.4 | < 0.001 |
| **Heart rate at 1 min** | 115 ± 5 | 105 ± 3 | < 0.001 |
| **Heart rate at 5 min** | 134 ± 4 | 125 ± 3 | < 0.001 |
| **Heart rate at 10 min** | 136 ± 2 | 137 ± 2 | < 0.001 |
| **Apgar score at 1 min** | 3.9 ± 1.0 | 5.6 ± 0.9 | < 0.001 |
| **Apgar score at 5 min** | 6.1 ± 1.1 | 7.0 ± 0.5 | < 0.001 |
| **Apgar score at 10 min** | 8.5 ± 1.6 | 9.6 ± 0.7 | < 0.001 |

## ABS 111

# PERI-OPERATIVE MANAGEMENT OF NEONATES WITH ESOPHAGEAL ATRESIA IN LOW-INCOME COUNTRIES: EXPERIENCE OF TUNISIA

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## INTRODUCTION

Esophageal atresia (EA) is a congenital anomaly that requires urgent diagnosis, transfer to a neonatal surgical centre and management by a multidisciplinary team. Peri-operative management needs vigilant monitoring for the possible associated

morbidities. Our study aims at disclosing clinical features of EA and analyzes its perioperative management.

METHODS

It is a retrospective, descriptive, population-based cohort study. All patients with EA born between 1 January 2010 and 31 December 2014 and treated in the Intensive Care Unit of Monastir (Tunisia) were included. All patients were operated in the Pediatric Surgery Department of Monastir.

RESULTS

A total of 54 patients with EA were treated. The incidence of EA was calculated in 1.6 per 1,000 live births. Antenatal diagnosis was suspected in 7% patients. Thirty six percent of newborns were preterm. Fifty two percent showed associated anomalies. The most common type of EA was Gross type C (94%). The median age at surgical intervention was 32 hours (1 to 120). The approach was thoracotomy in all cases. Infants had mechanical postoperative ventilation for at least 2 days (2-34). Postoperative contrast study of the esophagus was performed at median postoperative day 7 (4 to 24). Postoperative complications occurred in 24.6% of patients (thoracic wall abscess [13%], anastomotic leak [5.6%], and mediastinitis [4%]). A 22% mortality rate was reported, especially in cases of associated anomalies and very low birth weight. Nosocomial infection was the first cause of death in our population.

CONCLUSIONS

Improving care of EA in Tunisia is still difficult because of lack of optimal conditions either for both surgery and postoperative management in our intensive care units.

## ABS 112

## LESS INVASIVE SURFACTANT ADMINISTRATION IN PRETERM INFANTS. REVIEW AFTER 4 YEARS OF IMPLEMENTATION

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INTRODUCTION

Surfactant administration by less invasive technique (LISA) in preterm infants has been implemented in most neonatal units in the last few years due to the reduction in the outcome of death or BPD showed in RCTs [1]. Aims: To evaluate the impact of LISA technique after four years of its implementation in our unit over intubation rates and the survival free BPD (SF-BPD) outcome and to analyze associated risk factors for LISA failure (intubation requirement in the first 72 h after birth).

METHODS

Observational study of respiratory management of all preterm infants (less than 32 w GA) born in our unit from January 2012 to December 2016. LISA was implemented in 2014. The period of 2012-2013 is compared with 2015-2016 (n = 416).

RESULTS

Global intubation rates in the first 3 days of life (dol) do not differ between the two periods (48% vs 45.6%) but there is a reduction in median GA in the second period, 28.7 (26.7-30.7) in 2012-2013 vs 28 (26-30.2) in 2015-2016, and an increase in delivery room intubations in the second period (32% vs 34.2%). In the group of 26 to 29 weeks GA infants, intubation rates in the first 3 dol decrease from 54.3% to 44.5% with an increase in SF-BPD from 50.6% to 71.6% (p 0.008). Rate of surfactant use (55.6% vs 59.8%) and age at first dose (mean 2.8 vs 2.3) remain similar. Global Survival free BPD (II-III) has increased from 62.4% in 2012 to 69.7% in 2016. LISA was applied in 72 less than 32 w GA infants (median GA 28.2 [26.8-29.5]) with a rate of success (no MV in the first 3 dol) of 59.7%. Risk factors for LISA failure are lower GA and lack of $FiO_2$ reduction after surfactant. LISA failures are associated with an increased pneumothorax rate, total time of MV and BPDII-II rates. Results are presented in **Tab. 1**.

CONCLUSIONS

Survival-free BPD rate in less than 32 weeks has increased in the last four years, especially in the 26 to 29 weeks GA group of preterm infants, being LISA technique one of the lung protective strategies implemented during this period. Limitations: The results must be taken with caution due the study characteristics with some other modifications introduced during this period as an increased use in nasal ventilation (5.2% vs 30%, $p < 0.01$), increase rate of infants on HFOV at 3 dol (13.4% vs 25.5%, $p = 0.011$) and reduction in nosocomial sepsis (59.9% vs 43.5%).

REFERENCE

[1] Aldana-Aguirre JC, Pinto M, Featherstone RM, Kumar M. Less invasive surfactant administration versus intubation for surfactant delivery in preterm infants with respiratory distress syndrome: a systematic review and meta-analysis. Arch Dis Child Fetal Neonatal Ed. 2017;102(1):F17-23.

**Table 1 (ABS 112).** Clinical characteristics of the 2 groups.

| | | Intubation requirement first 3 days of live | | | | p |
|---|---|---|---|---|---|---|
| | | No | | Yes | | |
| | | n | %Col. | n | %Col. | |
| Median GA | | 28.2 | 26.9-29.5 | 27 | (25.7-29.5) | 0.01 |
| GA in groups | Less than 26 w | 0 | 0.00% | 10 | 34.50% | |
| | 26-29 w | 27 | 62.80% | 10 | 34.50% | |
| | 29-32 w | 16 | 37.20% | 9 | 31.00% | |
| | Total | 43 | 100.00% | 29 | 100.00% | < 0.001 |
| Antenatal steroids | No-inc | 18 | 41.90% | 7 | 24.10% | |
| | Yes | 25 | 58.10% | 22 | 75.90% | |
| | Total | 43 | 100.00% | 29 | 100.00% | 0.121 |
| Gender | Male | 25 | 59.50% | 16 | 55.20% | |
| | Female | 17 | 40.50% | 13 | 44.80% | |
| | Total | 42 | 100.00% | 29 | 100.00% | 0.715 |
| Choriamnionitis | No | 38 | 88.40% | 25 | 86.20% | |
| | Yes | 5 | 11.60% | 4 | 13.80% | |
| | Total | 43 | 100.00% | 29 | 100.00% | 0.785 |
| $FiO_2$ reduction | No | 5 | 11.60% | 22 | 75.90% | |
| | Yes | 38 | 88.40% | 7 | 24.10% | |
| | Total | 43 | 100.00% | 29 | 100.00% | < 0.001 |
| Patent ductus arteriosus | No | 25 | 58.10% | 12 | 41.40% | |
| | Yes | 18 | 41.90% | 17 | 58.60% | |
| | Total | 43 | 100.00% | 29 | 100.00% | 0.163 |
| Bronchopulmonary dysplasia | No | 15 | 34.90% | 3 | 10.30% | |
| | Mild | 19 | 44.20% | 10 | 34.50% | |
| | Moderate | 5 | 11.60% | 9 | 31.00% | |
| | Severe | 0 | 0.00% | 3 | 10.30% | |
| | Exitus | 4 | 9.30% | 4 | 13.80% | |
| | Total | 43 | 100.00% | 29 | 100.00% | 0.013 |
| Pneumothorax | 0 | 41 | 95.30% | 22 | 75.90% | |
| | 1 | 2 | 4.70% | 7 | 24.10% | |
| | Total | 43 | 100.00% | 29 | 100.00% | 0.014 |
| Intubation criteria | No | 38 | 88.40% | 22 | 75.90% | |
| | Yes | 5 | 11.60% | 7 | 24.10% | |
| | Total | 43 | 100.00% | 29 | 100.00% | 0.162 |
| Lisa first dose | No | 6 | 14.00% | 5 | 17.20% | |
| | Yes | 37 | 86.00% | 24 | 82.80% | |
| | Total | 43 | 100.00% | 29 | 100.00% | 0.704 |
| Total time MV | | 1 | (0-48) | 193 | (82-402) | < 0.001 |

## ABS 113

## COMPARISON OF RSV HOSPITALISATION IN PRETERM INFANTS WITH CHRONIC LUNG DISEASE WHO DO NOT QUALIFY FOR PALIVIZUMAB PROPHYLAXIS WITH THOSE WHO QUALIFY IN NOTTINGHAM, UK

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### INTRODUCTION

Palivizumab prophylaxis reduces the likelihood of serious respiratory tract infection by Respiratory Syncytial Virus (RSV) in ex-preterm infants with Chronic Lung Disease (CLD). The Nottingham CLD service follows Joint Committee on Vaccination and Immunisation (JCVI) guidelines

for Palivizumab prophylaxis based on gestation, respiratory status and chronological age at the beginning of RSV season. This retrospective observational study was conducted to compare the RSV hospitalisation in preterm infants with CLD who are offered Palivizumab to those with milder CLD not qualifying for the prophylaxis.

METHODS

We hypothesised that the RSV hospitalisation rate and length of hospital stay (LOS) within the 1st year of life between preterm babies in home oxygen with CLD immunised according to the JCVI criteria and babies with moderate CLD not discharged in home oxygen would be comparable. Our cohort included babies born in Nottingham UK between 2009 and 2015. Data was collected from hospital records and the Nottingham CLD database, and analysed using Fisher's exact test for proportions and Mann-Whitney test for continuous data.

RESULTS

In total there were 3,478 babies born preterm (< 37 weeks GA) in Nottingham UK from 2009 to 2015. 245 babies had CLD at 36 weeks corrected GA. 192 of these babies were discharged in Home Oxygen and 135 of these babies were eligible for Palivizumab (JCVI). Results are presented in **Tab. 1**.

CONCLUSIONS

The RSV hospitalization rate was lower in preterm infants who did not qualify for Palivizumab compared to infants who qualified according to JCVI guideline but this difference was not statistically significant. A large prospective multi-centre study is required to ascertain the clinical and economic benefits of including the wider group for Palivizumab prophylaxis.

**Table 1 (ABS 113).** Results in the 2 groups.

| Number of babies | Babies immunised according to JCVI criteria | Babies with CLD not discharged in Oxygen that would be eligible | p-value |
|---|---|---|---|
| **Total** | 135 | 53 | |
| **Confirmed RSV hospitalisations following discharge from neonatal unit within 1st year of life** | 13 (9.6%) | 3 (5.66%) | 0.56 |
| **Median LOS in days (IQR)** | 10.3 days | 7.3 days | Unable to calculate due to small numbers |

JCVI: Joint Committee on Vaccination and Immunisation; CLD: Chronic Lung Disease; RSV: Respiratory Syncytial Virus; LOS: length of hospital stay.

## ABS 114

## AN UNUSUAL CAUSE OF RESPIRATORY DISTRESS IN NEONATES: CONGENITAL PULMONARY LYMPHANGIECTASIA (TWO CASE REPORTS)

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INTRODUCTION

Congenital pulmonary lymphangiectasia (CPL) is a very rare condition characterized by abnormal dilation of the lymphatic draining interstitial and pleural spaces of the lung. Diagnosis is difficult because of the lack of specificity of the clinical and radiological signs. We report two cases of neonates with a severe form of CPL and emphasize the importance of the pathological examination of the lung in case of respiratory distress of undetermined etiology.

CASE REPORTS

*1st case*

This is a male newborn born at a term of 36 weeks by Caesarean section admitted at birth for severe respiratory distress. Initial X-ray showed a veiled aspect of the lungs with air bronchogram suggesting either maternal-fetal infection or respiratory distress syndrome. The newborn required mechanical ventilation and chest tube insertion for pneumothorax, first in the right lung then bilateral. The newborn died 15 days later despite resuscitation measures. The autopsy, performed after written consent from the parents, showed voluminous lungs with dilated cystic spaces. Histological examination of the lungs showed marked diffuse and bilateral lymphatic dilatations in the sub-pleural, peribronchiolar and interlobular spaces. The other organs were normal. These data confirmed the diagnosis of primitive CPL.

*2nd case*

This is a female newborn born at a term of 36 weeks by Caesarean section. Antenatal ultrasound showed hydramnios and right hydrothorax. She was admitted for severe respiratory distress. Radiography of the

thorax showed right fluid pleural effusion and an interstitial syndrome on the left side. The puncture of the effusion confirmed its chylous nature. The evolution was marked by the relapse of pleural effusion and the appearance of pneumothorax. The newborn required mechanical ventilation and pleural drainage. An exploratory thoracotomy performed confirmed the right pleural effusion without evidence of a malformation or a mediastinal tumor. A pulmonary biopsy with pathological examination suggested a LPC. The death occurred at the 7th day of life, in a table of severe hypoxia. The autopsy confirmed the diagnosis of CPL.

CONCLUSIONS

Although CPL is very rare, we should be aware that it is a possible cause of severe unexplained respiratory distress in neonates. The suspected diagnosis on clinical and radiological data should be confirmed by the pathologic study. Advances in neonatal resuscitation may help to improve the prognosis of this life threatening condition.

## ABS 115

## ETIOLOGICAL AND PATHOLOGICAL CORRELATIONS IN PERSISTENT PULMONARY HYPERTENSION OF THE NEWBORN

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INTRODUCTION

Persistent pulmonary hypertension of the newborn (PPHN) or persistent fetal circulation is defined as the neonate's inability to make the transition to the adult type of circulation after birth. PPHN occurs in 1-2/1,000 live births. PPHN is seen most often in late preterm and term infants, can be idiopathic or secondary to other pulmonary, cardiac, and infectious conditions. The idiopathic forms are often associated with elective cesarean section. Aim: The study aimed to define etiological and pathological correlations of PPHN by a case-control assessment.

METHODS

The retrospective study was performed in the regional center Sibiu between January 1 and December 31, 2015 and comprised all newborns diagnosed with PPHN during this period. For each neonate with PPHN two pair newborns were identified from the electronic database of the unit with similar gestational ages (GA) and a birth weight (BW) of ± 100 g. Anthropometric and epidemiological data, information regarding pregnancy, labor and birth, neonate's condition at birth, respiratory distress syndrome, pathology during hospitalization, and the need for neonatal intensive care unit (NICU) admission were collected from the neonatal charts. PPHN diagnosis was done based on Doppler echocardiography according to the severity of the tricuspid regurgitation. Collected data were analyzed comparatively between the study groups using SPSS® for Windows® 10.0, p was considered statistically significant if $< 0.05$ (confidence interval CI 95%).

RESULTS

45 cases of PPHN were identified during the study period in the regional center Sibiu (1.67% of the total number of admissions in the study period). Although the control cases were matched so that BW was ± 100 g compared to the pair case, the mean ponderal index of the PPHN infants was significantly higher ($p = 0.035$). Neonates with PPHN were more often inborn ($p = 0.000$, OR 15.82 [CI 95% 4.30-58.21]), delivered by cesarean section ($p = 0.001$, OR 1.52 [CI 95% 1.14-2.02]), without labor ($p = 0.000$, OR 1.81 [CI 95% 1.19-2.76]), had significantly lower Apgar scores at 1 and 5 minutes ($p = 0.033$, $p = 0.047$), were more often diagnosed with maternal-fetal infections ($p = 0.039$, OR 2.42 [CI 95% 1.03-5.67]), respiratory distress syndrome ($p = 0.000$, OR 7.50 [CI 95% 3.55-16.76]), transient tachypnea of the newborn ($p = 0.000$, OR 6.50 [CI 95% 2.62-16.11]). Also, the neonates with PPHN more often had anemia at birth ($p = 0.041$, OR 2.62 [CI 95% 1.03-6.66]), hypocalcemia ($p = 0.004$, OR 2.56 [CI 95% 0.97-6.78]), and needed more often to be admitted in the NICU ($p = 0.000$, OR 15.70 [CI 95% 5.95-41.69]). No significant differences were found between the study groups as regards the pregnancy type (single versus multiple, natural versus assisted reproductive techniques pregnancy), pathology during pregnancy, neonatal gender, the need for birth resuscitation, incidence of hypoglycemia and chronic lung disease of the preterm infant, hospitalization length (in NICU and total length), and the risk for death. Death occurred in 2 of the cases with PPHN (4.44%).

CONCLUSIONS

Consistent with data in the literature, PPHN was associated with delivery by cesarean section, transient tachypnea of the newborn, and neonatal respiratory distress but we also identified other

significant associations: perinatal hypoxia, birth anemia, hypocalcemia, maternal-fetal infection. PPHN can be a fearsome complication of many neonatal conditions and has an increased mortality risk. Knowledge of the risk factors for PPHN allows development of interventions designed to lower its incidence.

## ABS 116

## BRONCHOPULMONARY DYSPLASIA – ARE THERE NEW RISK FACTORS IN VERY PRE-TERM INFANTS?

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INTRODUCTION

Bronchopulmonary dysplasia (BPD) is the most severe late complication associated with prematurity, affecting later growth and neurological development. Aim: To identify risk factors for BPD in preterm infants ≤ 32 weeks of gestation.

METHODS

The study was conducted in the regional center of Sibiu. Data was collected from the National Register of Respiratory Distress Syndrome between 01.01.2011-31.12.2015. The study included all surviving infants ≤ 32 weeks GA. Anthropometric data, epidemiological data related to pregnancy, labor, birth, respiratory distress, and treatment were analyzed using SPSS® Windows® 10.0 for Windows®. Value of p was considered significant when < 0.050 (CI 95%).

RESULTS

During the study 391 premature infants with GA ≤ 32 weeks were admitted to the regional center of Sibiu. 38 of the 340 infants surviving to discharge were diagnosed with BPD (9.7%). Premature infants with BPD had mean GA (27.1 ± 1.9 weeks) and mean birth weight (947.3 ± 209.5 g) significantly lower compared to infants without BPD (p = 0.000), required more often resuscitation at birth (p = 0.007, OR 3.28), and had significantly lower Apgar scores at 1, 5, 10 minutes (p = 0.000). Duration of CPAP respiratory support (p = 0.000), mechanical ventilation (p = 0.000), oxygen therapy (p = 0.000) and hospitalization (p = 0.000) were significantly greater for the preterm infants with BPD. Statistically significant correlations were found between BPD and the need for surfactant administration (p = 0.000, OR 24.41), apnea of prematurity (p = 0.000, OR 41.01), neonatal sepsis (p = 0.000, OR 4.74), maternal-fetal infections (p = 0.000, OR 5.10), nosocomial infections (p = 0.000, OR 4.60), persistent ductus arteriosus (p = 0.002, OR 2.94).

CONCLUSIONS

Extreme prematurity, very low birth weight, hypoxia and the need for resuscitation at birth, severe respiratory distress, oxygen therapy, ventilator support, perinatal infections, and persistent ductus arteriosus were identified as risk factors for BPD.

## ABS 117

## OUTCOMES OF PRETERM INFANTS LESS THAN 26 WEEKS GESTATION AT BIRTH WHO RECEIVED CHEST COMPRESSION OR ADRENALINE DURING RESUSCITATION AT BIRTH

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INTRODUCTION

BAPM guideline recommends not use chest compression or adrenaline of any route during resuscitation of < 26 weeks gestation preterm infants. There is no good evidence to use or not to use chest compression or adrenaline in this gestation. Experts say not use as these infants in general have poor outcome. Aim: To evaluate the outcome of preterm infants < 26 weeks who received chest compression or adrenaline during resuscitation at birth.

METHODS

Retrospective study over period of 4 years (Jan 2011 to Dec 2014). Data was collected form Badger database. Our unit policy is in line with BAPM recommendation. But sometimes these infants receive chest compression or adrenaline because they born in other units and their policy may vary.

RESULTS

121 preterm infants less than 26 weeks were admitted to NICU during the study period. Number of infants received chest compression 12 and 2 infants also received adrenaline. Of the 12 infants only 7 survived till the discharge. Among the infants who received adrenaline 1 survived.

Among the survived at 2 year neurodevelopment evaluation: 1 had global developmental delay with

cerebral palsy, 2 normal neurology, 3 mild language delay and mild motor delay. The survived infant needing chest compression and adrenaline has mild language and motor delay.

CONCLUSIONS

Outcomes of preterm infants < 26 weeks still remains poor but gradually improving. Even though numbers are small in our study among the survivors the outcome is reasonably good. Only 1 baby had cerebral palsy at 2 year neurodevelopment assessment. Large studies are required to see whether there is real benefit in chest compression and at least one dose of adrenaline during resuscitation and birth.

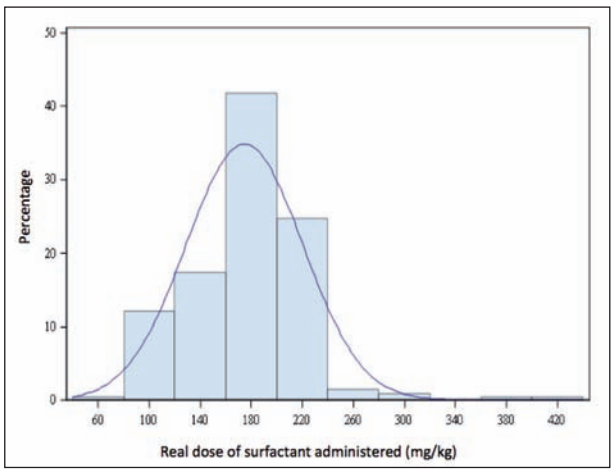


**Figure 1 (ABS 118).** Surfactant dose distribution (mg/kg).

## ABS 118

## EVALUATION OF SURFACTANT DOSE ADMINISTERED IN CLINICAL PRACTICE FOR THE TREATMENT OF RESPIRATORY DISTRESS SYNDROME (RDS): RETROSPECTIVE OBSERVATIONAL STUDY. SURPRAIS STUDY

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INTRODUCTION

According to clinical and pharmacokinetic data, the recommended initial dose of surfactant for the treatment of respiratory distress syndrome (RDS) is 200 mg/kg. However, the dose of surfactant used in clinical practice is frequently lower than the one recommended in European Guidelines. Thus, we performed this multicentre retrospective study to determine the real dose administered to preterm babies with RDS.

METHODS

Multicenter retrospective observational cohort study to evaluate the dose of surfactant administered to preterm babies with RDS, from January 2013 to December 2015 in 4 level III NICUs. Epidemiologic data, prescribed and administered dose of surfactant, respiratory support requirements and neonatal morbidities were analyzed. The need for surfactant was defined as a fraction of inspired oxygen ($FiO_2$) requirement ≥ 0.3 to achieve saturations between 90-95% in preterm babies with clinical symptoms of RDS. All participating centres prescribed by protocol a dose of 200 mg/kg of poractant alfa to treat RDS. A 10% variation of the intended dose (200 mg/kg ± 10%) was considered acceptable.

RESULTS

A total of 206 patients were analyzed (56.3% male) with a mean gestational age of 28 weeks (range 23.1 to 36.3 weeks) and a mean birth weight of 1,227.3 g (range 430-3,400 g). 58.3% was less than 29 weeks of gestation. 84% received at least one dose of antenatal steroids. The median time from birth to administration of surfactant was 210 minutes (range 60-480 minutes). The mean real administered dose of surfactant was 174.7 mg/kg with only 45.1% of the patients receiving a dose within the accepted range of 200 ± 10%, and 48.1% receiving < 180 mg/kg (**Fig. 1**). There was a statistically significant (p = 0.0132) relationship between the dose administered and gestational age, with higher doses in newborns with lower gestational ages. Redosing of surfactant was needed in 27.7% of the cases.

CONCLUSIONS

The real dose of surfactant administered for RDS was lower than the recommended one. Most of the patients received a dose outside the acceptable variation of 200 mg/kg ± 10%. Newborns with lower gestational ages receive significantly higher doses of surfactant.

DECLARATION OF INTEREST

This study was performed with the financial support of Chiesi. We believe that being a retrospective observational study the results cannot be biased.

## ABS 119

## LUNG ULTRASOUND TO ASSESS PERSISTENT PULMONARY HYPERTENSION OF THE NEWBORN ETIOLOGY

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INTRODUCTION

Persistent Pulmonary Hypertension of the Newborn (PPHN) is defined by the failure of post-natal reduction in pulmonary vascular resistance with significant morbidity and mortality associated. Conventional management of PPHN includes inotropes, mechanical ventilation and exogenous inhaled nitric oxide (iNO). In extreme cases, patients can require Extracorporeal Membrane Oxygenation therapy (ECMO), although they do not have a causal diagnosis. Lung ultrasound (LUS) has proved to be extremely useful to diagnose pulmonary diseases. The aim of this study was to explore LUS pattern in newborns with PPHN requiring ECMO. We hypothesized that patients with a normal LUS had a no lung parenchymal disease and that LUS was as useful as CXR to reach the causal diagnosis.

METHODS

This is a prospective study of LUS to assess PPHN etiology in patients admitted for ECMO, with patients recruited from 2014 to 2016 at Hospital Sant Joan de Déu at the NICU. PPHN diagnosis was based on clinical and echocardiographic findings. LUS was performed by a neonatologist blinded to the perinatal history, before the patient was placed in ECMO, scanning four lung areas in each hemithorax; we compared with CXR diagnosis. The final PPHN diagnosis was made by a senior consultant expert in lung disease taking into account patient's complete medical history, including CXR, echocardiographic results, blood results or histology evaluation among others, except for LUS information.

RESULTS

Fifteen patients were recruited. Ten were male (66.7%) and the median gestational age was 38.3 weeks, with eleven term newborns (80%). None of them presented prenatal ultrasonographic alterations that could guide the causal diagnosis of PPHN (anhydramnios/oligohydramnios, kinking PDA or early closure of PDA). In 12 cases the symptoms were of early onset, beginning in the first 24 hours of life; the other three patients remained asymptomatic until 2, 6 and 8 days of life. Twelve were under veno-arterial ECMO treatment and the median ECMO run was 122.7 hours. Eight survived. LUS and CXR reached the same diagnosis in 26.6% cases. Patient with a normal LUS (A-lines) had a no lung parenchymal disease in 89% (3 Alveolar Capillary Dysplasia, 3 sepsis, 2 premature closure of PDA). Comparing with the definitive diagnosis, LUS established the correct one in 93% cases, while CXR did in 46.6%.

CONCLUSIONS

LUS has advantages over conventional radiology because it is non-invasive, free of ionizing radiation, available at bedside, with high concordance between observers and easy to learn, being especially useful in critically ill patients. LUS can provide additional information that helps to reach the causal diagnosis of PPHN in an early and more effective way compared to CXR being suitable for routine application in the NICU.

## ABS 120

## IMPROVEMENT OF FACE MASK VENTILATION TECHNIQUE USING A LIVE FEEDBACK SYSTEM

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INTRODUCTION

Between 3-6% of all newborn infants require positive pressure ventilation at birth, hence it is essential that staff caring for newborns master this skill. The leak when ventilating a newborn is often more than 50% without the operator knowing. With such a large leak, targeted tidal volumes are not achieved. Finding a way to improve and master this skill is essential in the resuscitation of the newborn infant. Each individual is different and there is not one absolute right technique, one needs to find a way that suits them and which is effective. The aim of this study is to assess a live feedback system in improving mask ventilation.

METHODS

Neonatal Nurses and Doctors were asked to participate over 2 days. This longitudinal crossover trial was carried out in 2 phases with the same instructions "administer ventilation breaths to a term baby, rate of 30/minute for 1 minute. You will be assessed on your technique": 1) Live feedback blinded with instructions; 2) Live feedback visible. In between, an individual training session supported by a neonatologist up to 3 minutes with live feedback

**Table 1 (ABS 120).** Comparing medians of tidal volumes, leak and scores with and without live feedback.

| | Pre-training without live feedback | Post-training + live feedback |
|---|---|---|
| **Tidal volume: median (IQR) of percentages of breaths within the range in range** | 7 (0-74) | 76 (13-96) |
| **Leak: median (IQR) of percentages of breaths with a leak below 10%** | 87 (48-100) | 96 (73-100) |
| **Total score: median (IQR)** | 59 (36-68) | 72 (58-94) |

monitor. Equipment used was the mannequin "Baby Anne", a Neopuff (pressures 30/5), live feedback system NewLifeBox. Goals set were (error margins 10%): Tidal volume 4-8 mls/kg, leak below 10%, rate 30-60/minute. Score was calculated combining the percentages of breaths within range with different weights: tidal volume (40%), leak (40%), rate (20%).

RESULTS

Overall 58% (11/19) of the candidates had an improvement of tidal volume being within target (4-8 ml/kg), 41% (7/17) had an improvement of the leak. Only 2 candidates had an overall rate out of range before training, but 100% of candidates had a good rate with the live feedback system after training. There is an improvement also in terms of medians of breaths within range of tidal volumes and leaks, and overall scores of the candidates (**Tab. 1**).

CONCLUSIONS

Training with a live feedback improves mask ventilation technique. Learning is done by reflection-in-action, an effective adult educational technique. Having an assessment score is also motivational. A live feedback system may also be useful in real life resuscitation: we think it may be if there is a designed person for exclusive airway management as it may also be a distraction and cause too much focus losing the broader picture of the resuscitation.

## ABS 121

## NEURALLY ADJUSTED VENTILATION IN PATIENTS WITH CONGENITAL DIAPHRAGMATIC HERNIA

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INTRODUCTION

Neurally adjusted ventilatory assist (NAVA) is a ventilatory mode that uses diaphragmatic electrical activity (Edi) to synchronize and give the patient proportional assistance to their respiratory effort. Congenital Diaphragmatic Hernia (CDH) is a severe lung disease that combines pulmonary hypoplasia with diaphragm defect that could altered Edi signal. Our aim is to describe the clinical characteristics, respiratory parameters, comfort and weaning of patients with CDH ventilated in NAVA mode in our unit.

METHODS

Retrospective review of medical records. We included those newborns with CDH who received NAVA mode in our unit during a 2 years period (Jan 2015-Feb 2017). General variables, respiratory parameters (NAVA level, peak and minimum Edi, respiratory rate, PIP, MAP, PEEP, oxygen and $PCO_2$) and early morbidity data were collected.

RESULTS

N = 6. Mean birth weight 2,944 ± 486 g. Mean gestational age 38.2 ± 1.4 w. 86% male sex. All had persistent pulmonary hypertension. NAVA in mechanical ventilation (MV-NAVA) was applied in 5 patients. All received previous MV with 11-63 d duration (median 17 d). It was used for weaning, with an average duration of 2.2 ± 1.7 d. Maximum NAVA level was 1.8 ± 0.3 μV/cm$H_2O$, reaching 1.2 ± 0.5 h from the onset of MV-NAVA. Clinical improvement, greater synchronization and comfort in 80% (4/5); no adequate Edi signal in 1 patient with hemidiaphragmatic agenesis. Extubation to Non-Invasive NAVA (NIV-NAVA) in 80% (4/5) with failure in 1 patient related to nosocomial sepsis. Extubation age 11-63 d (median 20.5 d). NIV-NAVA was applied to 5 patients with duration of 4-29 d (median 6 d). NAVA maximum level in NIV-NAVA 2.4 ± 0.8 μV/cm$H_2O$, reaching at 21 h median (1-312 h). Ventilation parameters are presented in **Tab. 1**.

CONCLUSIONS

NAVA mode in patients with HDC is possible and it could be an effective option for ventilation in these patients, allowing a better synchronization and favoring weaning.

**Table 1 (ABS 121).** Ventilation parameters.

| | MV-NAVA | NIV-NAVA |
|---|---|---|
| NAVA level (μV/cm$H_2O$) | 1.5 ± 0.4 | 1.9 ± 0.9 |
| Peak Edi (μV) | 9-14 | 7.3-15 |
| Minimum Edi (μV) | 1-2 | 0.8-2 |
| Minimum PIP (cm$H_2O$) | 15.2 ± 4.2 | 20.1 ± 7 |
| Maximum PIP (cm$H_2O$) | 18.3 ± 3.9 | 23.4 ± 6.4 |
| Minimum MAP (cm$H_2O$) | 8.3 ± 1.5 | |
| Maximum MAP (cm$H_2O$) | 9.7 ± 2 | |
| PEEP (cm$H_2O$) | 4.8 ± 0.6 | 7.3 ± 1.5 |
| Minimum Respiratory Rate (rpm) | 54.5 ± 11.1 | 56.2 ± 12.4 |
| Maximum Respiratory Rate (rpm) | 63.6 ±11.3 | 67.5 ± 9.3 |
| Minimum Tidal Volume (cc/kg) | 7.3 ± 5 | |
| Maximum Tidal Volume (cc/kg) | 10.3 ± 9 | |
| $iFO_2$ | 0.3 ± 0.1 | 0.3 ± 0.1 |
| $pCO_2$ (mmHg) | 47.5 ± 9.8 | 52.7 ± 6.4 |

Results expressed as mean ± standard deviation or median.
NAVA: neurally adjusted ventilatory assist; MV-NAVA: NAVA in mechanical ventilation; NIV-NAVA: Non-Invasive NAVA; Edi: diaphragmatic electrical activity.

## ABS 122

## NON-INVASIVE NEURALLY ADJUSTED VENTILATION IN THE NEWBORN

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### INTRODUCTION

Neurally adjusted ventilatory assist (NAVA) is a ventilatory mode that uses diaphragmatic electrical activity (Edi) to synchronize and give the patient proportional assistance to their respiratory effort.

Our aim is to describe the clinical characteristics, respiratory parameters and comfort of ventilated patients with Non-Invasive Neurally Adjusted Ventilation (NIV-NAVA) in our unit.

### METHODS

This is a retrospective review of medical records. We included newborns with NIV-NAVA in our unit during 2 years (Jan 2015-Feb 2017). General variables, respiratory parameters during first 7 d NIV-NAVA and prior to withdrawal (NAVA Level, peak/minimum Edi, respiratory rate, PIP, PEEP, oxygen and $PCO_2$) and early morbidity data were collected.

### RESULTS

N = 15. Birth weight 490-3,520 g (median 1,109 g), gestational age 24.4-40.4 w (median 28.7 s). 73.3% male sex, 60% (9/15) preterm, 33.3% (5/15) congenital diaphragmatic hernia (CHD), 20% (3/15) pulmonary hypoplasia, 13.3% (2/15) chylothorax, 6.7% severe pneumonia and 1 absence of respiratory effort. NIV-NAVA was started at 9-87 d (median 30 d), with duration of 4-57 days (median 10 d). It was used as post-extubation support in 53.3% (8/15), receiving mechanical ventilation in NAVA mode in 40% of the cases. Ventilation time ranged 7-87 d (median 19 d), prior extubation failure 46.7%. Maximum NAVA level was 2.6 ± 0.9 μV/cm$H_2O$, reaching at a median of 24 h (6-1,368 h). Ventilation data are presented in **Tab. 1**. Clinical improvement, better synchronization and better comfort were evidenced in 14 of the 15 patients (93.3%). 73.3% (11/15) patients had severe BPD, hospital stay 24-154 d (median 101 d). 46% (7/15) required home oxygen.

**Table 1 (ABS 122).** Ventilation data.

| | NIV-NAVA |
|---|---|
| NAVA level (μV/cm$H_2O$) | 2.1 ± 1.1 |
| Peak Edi (μV) | 8-15 |
| Minimum Edi (μV) | 0.8-2.3 |
| Minimum PIP (cm$H_2O$) | 19.5 ± 6.3 |
| Maximum PIP (cm$H_2O$) | 23.2 ± 5.8 |
| PEEP (cm$H_2O$) | 7.7 ± 1.4 |
| Minimum Respiratory Rate (rpm) | 49.4 ± 11.4 |
| Maximum Respiratory Rate (rpm) | 65 ±11.3 |
| $iFO_2$ | 0.35 ± 0.16 |
| $pCO_2$ (mmHg) | 55 ± 9.4 |

Results expressed as mean ± standard deviation or median.
NAVA: neurally adjusted ventilatory assist; NIV-NAVA: Non-Invasive NAVA; Edi: diaphragmatic electrical activity.

### CONCLUSIONS

NIV-NAVA is a ventilatory mode applicable in the RN in our environment. It allows better synchronization in NIV, with greater comfort for the patient and clinical improvement.

## ABS 123

## IMPACT OF PRETERM BIRTH ON RESPIRATORY MUSCLE FUNCTION IN CHILDHOOD

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### INTRODUCTION

Studies in newborn infants have shown that respiratory muscle function is influenced by

maturation at birth. In preterm infants, the tension time index of the respiratory muscles (TTmus – a composite index that reflects the balance between the capacity of a muscle and the load imposed upon it) is higher, signifying impaired respiratory muscle function and increased risk of respiratory muscle fatigue under demanding respiratory conditions. However, the long-term impact of prematurity on respiratory muscle function remains unknown. The aim of the present study was to investigate whether prematurity affects the respiratory muscle function in school-aged children.

METHODS

Thirty four subjects born at a gestational age (GA) of 35.5 ± 3.4 weeks (range 29-40), underwent respiratory muscle function measurements (maximal inspiratory pressure [MIP] and TTmus): a) before discharge from the NICU at a median post-menstrual age of 38 weeks (range 36-42 weeks) (labels: nMIP, nTTmus), and b) at the age of 6 to 7 years (mean 6.4 ± 0.2 years) (labels: chMIP, chTTmus). TTimus was measured by an in-built device, using the formula PTimus = (Pimean/MIP) x (Ti/Ttot). Pimean was calculated as 5 x P0.1 x Ti. P0.1 is the inspiratory pressure (Pi) at 100 msec after an occlusion, Ti the inspiratory time, and Ttot the duration of the respiratory cycle. None of the participants had chronic lung disease of infancy, received oxygen or other respiratory support during measurements in the neonatal period, or had a history of current asthma (symptoms or medication in the previous 2 years) at school age.

RESULTS

In comparison to children born at term (N = 18), preterm-born subjects (N = 16) had lower nMIP (57.3 ± 14.2 vs. 69.8 ± 15.0 $cmH_2O$; p = 0.019), lower chMIP (65 ± 8.4 vs. 75.1 ± 8.5 $cmH_2O$; p = 0.002), higher nTTmus (0.09 ± 0.03 vs. 0.07 ± 0.01; p = 0.011), and higher chTTmus (0.11 ± 0.02 vs. 0.09 ± 0.02; p = 0.014). GA was significantly correlated with nMIP (r 0.389; p = 0.023), chMIP (r 0.674; p < 0.001), nTTmus (r -0.553; p = 0.001), and chTTmus (r -0.551; p = 0.001). nTTmus and chTTmus Z scores were also significantly correlated (r 0.597; p < 0.001); the above relationship remained strong and unaffected after adjustment for subjects sex, BMI at school age or GA at birth (linear regression coefficient 0.406; p = 0.016; $R^2$ 0.486) (**Fig. 1**).

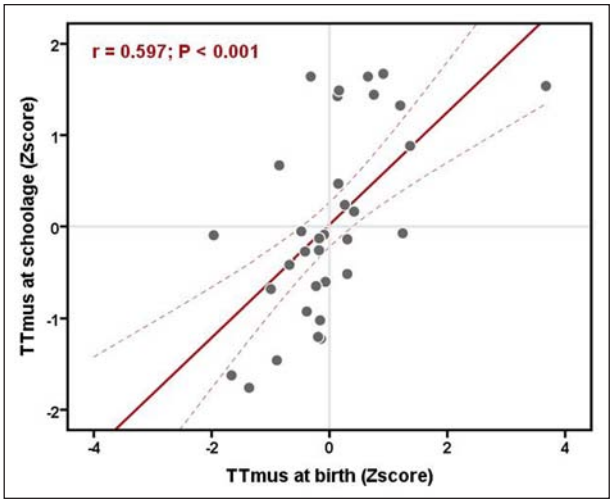


**Figure 1 (ABS 123).** Correlation between TTmus at birth and at school age.

CONCLUSIONS

Preterm-born children have impaired respiratory muscle function both at birth and at school age. Our findings suggest that the functional immaturity of the respiratory muscles due to preterm birth may echoes in early childhood.

## ABS 124

## THE NON-INVASIVE RESPIRATORY SUPPORT FAILURES IN PRETERM INFANTS. RISK FACTORS AND OUTCOMES

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INTRODUCTION

Nowadays, Respiratory Distress Syndrome in preterm infants is initially managed with non-invasive support in order to avoid ventilator induced lung injury. Nasal CPAP, Less Invasive Surfactant Administration (LISA) and nasal ventilation use is increasing in the last years but still, a quite large proportion of preterm infants finally need to be intubated and exposed to invasive ventilation (iMV). Aims: To assess the rate of iMV exposure in preterm infants of less than 32 weeks Gestational Age (GA) during hospitalization in the last 5 years in our unit and to analyze risk factors for intubation requirement and its implication in survival free bronchopulmonary dysplasia (BPD).

METHODS

Observational study of all preterm infants born in our unit from January 2012 to December 2016. Respiratory management from birth, perinatal factors and comorbidities as PDA and nosocomial infections were recorded.

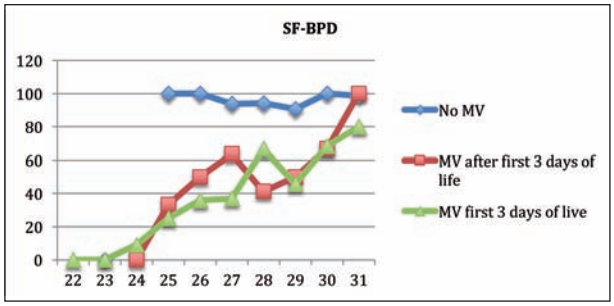


**Figure 1 (ABS 124).** Survival-free bronchopulmonary dysplasia (BPD) according to mechanical ventilation (MV) exposure by gestational age (GA).

## RESULTS

510 infants were included. The proportion of infants supported with nCPAP in the first 2 h of life remains constant, 56.5% vs 56.2% but there is a significantly increase in the use of nasal ventilation, from 0.9% in 2012 to 32.6% in 2016 ($p < 0.01$). LISA technique was implemented in 2014 with a proportion of use of 24% in 2014 and 27.3% in 2016. During this period intubation rates during hospitalization has been reduced from 61.5% (2012-2013) to 55.4% (2015-2016) despite an increase in the proportion of preterm infants of less than 29 w GA (56.5% to 63%). Independent risk factors for intubation requirement in the first 3 days after delivery were GA, gender male and lack of prenatal steroids, and after the first 3 days GA, PDA and nosocomial infection. Independent factor for the combined outcome of death or BPD II-III were GA, abnormal prenatal ultrasound (IUGR, pathological Doppler or oligohydramnios/polyhydramnios) and MV requirement, especially if applied in the first 2 hours after delivery, independently of total time (hours) of MV. Survival-free BPD according to MV exposure by GA is presented in **Fig. 1**.

## CONCLUSIONS

GA is the most important risk factor associated to intubation requirement. Risk factors associated to the combined effect of Death or BPD (II-III) (GA, abnormal prenatal ultrasound and intubation requirement in the first 2 hours after delivery) seems to be reflective of a fetal disease that is already present at birth and enhancing by mechanical ventilation.

## ABS 125

## SELECTIVE LUNG VENTILATION: A THERAPEUTIC STRATEGY FOR ACQUIRED LUNG COLLAPSE IN A TERM INFANT

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## INTRODUCTION

Lung collapse can occur in neonates. It can occasionally lead to compensatory lobar emphysema making difficult to ventilate. It has been reported in preterm infants as a complication of respiratory distress syndrome. Described treatments are high-frequency oscillation, and surgical management with a lobectomy. To our knowledge, there is no literature on acquired lobar emphysema in term infants, furthermore the therapeutic strategy of selective lung ventilation has never been reported.

## CASE REPORT

We describe a case of a term infant, difficult to ventilate due to lung collapse and compensatory acquired lobar emphysema, managed successfully with selective lung ventilation. This female infant was born at 40 weeks gestation by c-section in poor condition. Apgar scores were 5 at 1 min and 7 at 5 min. Resuscitation consisted of mask ventilation and intubation. Oxygen requirement gradually increased to 100% at 4 hours of age. The first chest Xray (CXR) showed a complete right-sided collapse, and a hyperexpanded left lung with mediastinal shift (**Fig. 1**). The endotracheal tube was in a correct position at T2. A lung US was preformed which confirmed the absence of a pneumothorax. She was also being treated for sepsis. CRP was within normal limits. Different ventilation strategies were used such as positioning with the collapsed side up, high frequency ventilation, and a trial of nitric oxide. There was however no evidence of pulmonary hypertension on the echocardiogram. These were all stopped

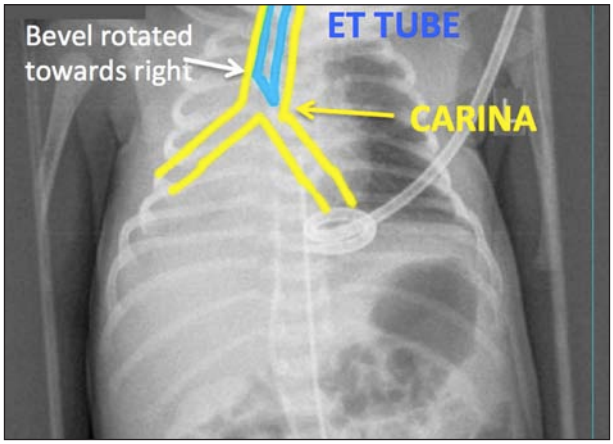


**Figure 1 (ABS 125).** The first chest Xray (CXR) of the newborn.

after 24 hours as there was no improvement. A CT chest done on day 2 showed the absence of any structural problems, but showed some intra luminal thickening of the right bronchus which could just be due to increased secretions. Following all investigations, the endotracheal tube was advanced slightly in order that it would be estimated to sit just above the carina with the bevel turned towards the right side, and the baby with right side up. Within 30 minutes the oxygen requirement was below 30%. CXR showed right lung opening up. However the next problem faced was alternate lung collapse, which was managed with tube positioning. She was discharged a week later, and at 2 months of age, has remained clinically well with no further respiratory symptoms and her development is normal.

CONCLUSIONS

Selective lung ventilation is technically challenging. But this case has demonstrated possibility of selective lung ventilation for managing collapsed lungs by a neonatologist without specific equipment like a bronchoscopy. Further studies are necessary to advice the absolute effectiveness of this therapeutic strategy.

## ABS 126

## SUDDEN UNEXPECTED COLLAPSE OF NEWBORN INFANTS: INCIDENCE, RISK FACTORS AND ROLE OF PERINATAL TRANSITION

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INTRODUCTION

Sudden unexpected postnatal collapse (SUPC) in apparently healthy babies have a reported incidence of 2.6-133 cases per 100,000 live births of term or near-term infants and have been associated with initial, unsupervised breastfeeding, prone position and distractions of the caregivers. Objective: We here further characterize the incidence of SUPC, possible and preventable risk factors, and the underlying mechanism. We hypothesize that PGE2, increased after birth, induce an attenuation of hypoxia and hypercapnia responses in the newborn that contribute to the SUPC events.

METHODS

All patient records from live-born infants in the seven delivery wards in Stockholm during a 13-year period (2002-2015) were screened for diagnosis (ICD-codes), and each possible case of SUPC was thoroughly investigated. Inclusion criteria was gestational week > $35^{+0}$, 10 min APGAR > 8, Umbilical artery pH > 7.0, Base Excess > -12, no obvious malformation and considered healthy at birth. Maternal, infant, event characteristics and outcome data collected. As a comparison GBS sepsis, culture verified and presumed, during the first postnatal week was investigated in the same population. Furthermore, a prospective study of new SUPC cases in the region (7 delivery wards with > 26,000 newborn/year) started 2016 with routines for reporting and obligatory examinations. A battery of tests including sampling of plasma and urine for inflammatory biomarkers (e.g. urinary-PGE metabolites such as PGEM) were implemented in new SUPC cases.

RESULTS

Among 263,738 live born infants in Stockholm county 2002 - 31 December 2015, 111 cases of SUPC in apparently healthy infants have been revealed. The incidence of 1 SUPC out 2,376 alive newborn babies is fifteen times higher than in recent UK and German national studies. The majority of SUPC cases occurred during the first 24 postnatal hours (**Fig. 1**) when the newborn was in a prone position. 8 died and of survivors 21 had subsequent HIE. During the first day of life all term newborns

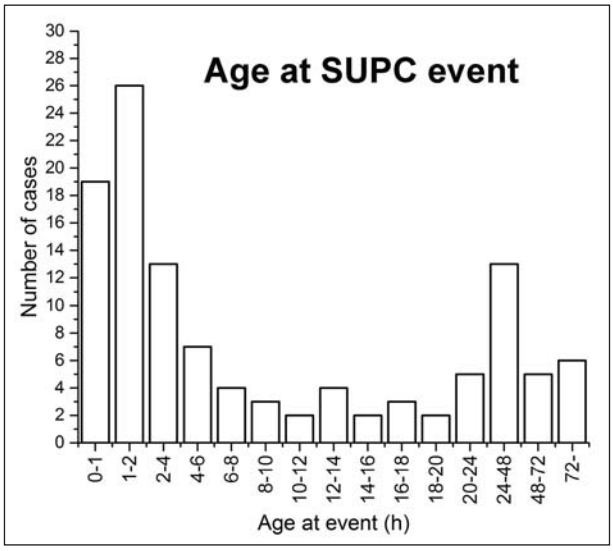


**Figure 1 (ABS 126).** Distribution of cases of sudden unexpected postnatal collapse (SUPC) in relation to age at SUPC events.

exhibit high levels of PGE2 and urinary PGEM that rapidly decrease within the first 48-72 postnatal hours. In SUPC/SUDI cases where urine or CSF was analyzed, PGE2 metabolites were increased compared to age matched controls and 7/8 SIDS occurred during the first 24 hours of postnatal life. GBS Sepsis was diagnosed in 81 infants, half verified by culture from infant, one infant died.

CONCLUSIONS

SUPC is more prevalent than previously reported and causes more deaths than GBS sepsis in term or near-term infants that are considered healthy. SUPC is a risk of all newborns especially during the first 24 hours after birth, when newborns autonomic cardiorespiratory responses are attenuated by PGE2 and associated with prone position and early unsupervised Skin-to-Skin care. National and international guidelines for prevention of SUPC and Safe Sleep and Safe Skin-to-Skin care should be implemented to save the lives of newborn babies.

DECLARATION OF INTEREST

E.H. is a coinventor of a patent application regarding biomarkers and their relation to breathing disorders (WO2009063226). The other authors declare no conflicts of interest.

## ABS 127

## INCIDENCE OF RESPIRATORY MORBIDITY IN LATE PRETERM AND TERM INFANTS IN RESPECT TO DELIVERY MODE

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INTRODUCTION

In late preterm neonates (34-36 weeks gestational age, GA) and early term neonates (37-38 weeks GA) respiratory morbidity is the main reason for admission to a neonatal intensive care unit (NICU) and is mainly attributable to dysfunctional reabsorption of lung fluid, also known as transient tachypnea of the neonate. Antenatal betamethasone to women with late preterm and early term delivery is effective in reducing the rate of neonatal respiratory complications. Before considering an implementation of antenatal betamethasone to women beyond 33 weeks GA we were interested to know the incidence of respiratory morbidity and the effect of delivery mode in our region over the last decade.

METHODS

This work was a cohort study including 23,928 prospectively recorded deliveries after 33 weeks of gestation at the University Hospital Zurich from 2007 to 2016. We analyzed the effect of caesarean section (CS) before the onset of labor (planned CS, PCS) on NICU admission due to respiratory morbidity compared with spontaneous vaginal delivery (SVD), vaginal-operational delivery (VOD), secondary CS (SCS, after the onset of labor) or emergency CS (ECS). Descriptive statistics were performed.

RESULTS

After excluding all infants with birth defects (n = 802) and those with incomplete data (n = 34) 23,092 deliveries were analyzed with 1,946 infants admitted to NICU after birth because of respiratory morbidity. Respiratory morbidity was found in 4.9% of all SVD, 7.2% VOD, 12.4% PCS, 12.7% SCS and 15.2% ECS. When comparing the percentage (%) of respiratory morbidity after SVD to PCS per week of GA the following was found: 34 weeks 65.9 to 74.6, 35 weeks 35.5 to 54.6, 36 weeks 18.0 to 28.7, 37 weeks 5.1 to 10.5, 38 weeks 3.4 to 5.2, 39 weeks 3.1 to 1.8, and 40 and more weeks 3.0 to 5.3. The rate of respiratory morbidity after PCS decreased during the observation period. The highest value was in 2009 and 2010: 16.2%, the lowest value in 2015 and 2016 with 7.7% ($p < 0.001$).

CONCLUSIONS

The risk for respiratory morbidity and NICU admission of infants born after 33 weeks GA was 2.5 fold higher after PCS compared to SVD with lowest risk for infants delivered after 38 weeks GA. We did not notice a reduced respiratory morbidity after CS during the study period but a change in coding practice of PCS or SCS. Thus, respiratory morbidity remains an important issue in late preterm and early term infants.

## ABS 128

## PREVENTION OF HYPOCAPNIA WITH INHALATIVE $CO_2$ IN NEONATES WITH HYPOXIC-ISCHEMIC ENCEPHALOPATHY – THE HENRIC STUDY

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INTRODUCTION
Asphyxiated infants often develop hypocapnia due to hyperventilation caused by metabolic acidosis, by therapeutic hypothermia, which reduces the metabolic rate, or by vigorous mechanical ventilation. Hypocapnia has been consistently associated with adverse neurodevelopmental outcome in recent clinical trials. Preventing hypocapnia is desirable in asphyxiated infants; however, currently no reliable technique is available to achieve this goal. Our aim was to test the feasibility and safety of low concentration of inhalative $CO_2$ gas mixture (5% $CO_2$ + 95% air) (NCT02700854) in maintaining arterial $pCO_2$ levels at 40-60 mmHg in asphyxiated, cooled, mechanically ventilated neonates.
METHODS
Term asphyxiated infants undergoing hypothermia treatment with a temperature corrected arterial $pCO_2$ less than 40 mmHg within 6 hours of life were enrolled. The 5% $CO_2$ gas mixture was administered through patient circuits in conventional ventilators. The endpoint of $CO_2$ inhalation was determined by recovery of metabolic acidosis, when base deficit decreased below 5 mmol/L. The maximum duration of $CO_2$ exposure was set at 12 hours. The primary outcome was the percentage of time spent in the desired $pCO_2$ range of 40-60 mmHg during 5% $CO_2$ inhalation. Arterial blood gas samples were taken regularly to ensure targeted $pCO_2$ levels. Doppler ultrasound measurements of cerebral blood flow velocities were performed during the treatment. We report our experience with the first 7 patients recruited.
RESULTS
Ventilation with 5% $CO_2$ was commenced at 5.03 ± 0.60 hours after birth and continued for 6.57 ± 4.56 hours. While inhaling 5% $CO_2$, patients spent 90.6% of the total time between the target $paCO_2$ range of 40-60 mmHg. Importantly, all $pCO_2$ values were above 40 mmHg, the threshold for hypocapnia. The base deficit decreased below 5 mmol/L at a median of 12.25 [IQR 5.9; 49.6] hours after birth. The median time of recovery from acidosis (pH > 7.25) was 8.07 [3.4; 17.4] hours after the initiation of 5% $CO_2$ inhalation. We detected a significantly increased respiratory rate (RR before 37/min [33; 48]; RR during 49/min [34; 55]; and RR after 30/min [22; 43]; $p < 0.0001$) and tidal volume (VT before 5.0 ml/kg [5.0; 7.6]; VT during 8.9 ml/kg [6.0; 12.0] and VT after 4.6 [3.8; 4.9]; $p = 0.0012$) during the $CO_2$ inhalation. Cerebral blood flow velocities did not change during the treatment. We did not observe any case of pulmonary or circulatory failure.
CONCLUSIONS
Inhalative 5% $CO_2$ administration is a physiologically plausible and straightforward intervention for preventing hypocapnia. If feasibility and safety will be proven proven, further studies are warranted to test the efficacy of $CO_2$ inhalation in providing better neurodevelopmental outcome in asphyxiated neonates treated with hypothermia. Prevention of hypocapnia is likely to be an important step to optimize neuroprotection in this patient population.

**ABS 129**

## RISK FACTORS ASSOCIATED TO SURVIVAL FREE BRONCHOPULMONARY DYSPLASIA ACCORDING TO GESTATIONAL AGE

C. Ramos-Navarro, S. Zeballos-Sarrato, E. Sanz-Lopez, E. Maderuelo-Rodriguez, N. Gonzalez-Pacheco, M. Sánchez-Gómez de Orgaz, M. Sánchez-Luna

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INTRODUCTION
Bronchopulmonary dysplasia (BPD) is a frequent morbidity in preterm infants, being gestational age the main important associated risk factor. Aims: to identify risk factors associated to the combined outcome of death or BPD in preterm infants grouped by GA in less than 26 w GA, $26^{+1}$ to 29 and $29^{+1}$ to 32 w GA.
METHODS
Observational longitudinal study including all preterm infants of less than 32 w GA preterm infants born in our unit from January 2012 to December 2016. Prenatal and postnatal risk factors were recorded
RESULTS
A total of 510 preterm infants were included. The incidence of the combined outcome of death or BPD (II-III) is 82% in less than 26 w GA, 39.4% in $26^{+1}$ to 29 w GA and 9.6% in $29^{+1}$ to 32 w GA. Survival free BPD has increased during this period from 62.4% in 2012 to 69.7% in 2016, specially in the group of 26 to 29 (48.8% to 73.5% [p 0.008]). Antenatal steroids treatment and GA in weeks were the factors associated to reduction in the Death or BPD outcome in less than 26 w GA group. Survival free BPD is

32.5% in the group of less than 26 w with a complete course of antenatal steroids compared to 5.5% in the group with lack or incomplete course. In contrast, in the group of $26^{+1}$ to 29 w GA preterm infants, SF-BPD is reduced in the group of infants with antenatal steroids (54.3% vs 70.4%). In this group, MV requirement, total duration of MV (hours), GA and prenatal abnormal ultrasound increase the death or BPD (II-III) outcome. In the group of infants of $29^{+1}$ to 32 w GA, MV requirement in the first 3 days of life, total duration of MV, PDA, prenatal abnormal ultrasound and GA are the implicated factors (**Tab. 1**). After comparing the antenatal steroids groups, there is an increase in intubation at delivery, increase in MV exposure in the first 2 h after birth, high frequency oscillatory ventilation support at 3 dol, PDA, neurological impairment, mortality, and the combined effect of mortality or BPD III in the group with lack of a complete course of antenatal steroids but, in this group, there is decrease incidence of abnormal prenatal ultrasound 18.9% vs 32.2% (p 0.001) that could be acting as a confusion factor.

## CONCLUSIONS

Risk factor associated to the combined outcome of death or BPD differs depending on GA. Main risk factors are GA and Mechanical Ventilation exposure. Infants of less than 26 w GA are a high-risk group in which antenatal steroids treatment has a protective effect. In contrast, steroids treatment has a paradoxical effect in the group of 26 to 29 w GA preterm infants that may reflect some confusion factors.

**Table 1 (ABS 129).** Risk factors associated to the combined outcome of death or bronchopulmonary dysplasia (BPD) in preterm infants on the basis of gestational age.

| | | Sig. | Exp(B) | I.C. 95% para EXP(B) | |
|---|---|---|---|---|---|
| **< 26 WGA** | **Antenatal steroids** | **0.003** | 0.119 | 0.029 | 0.48 |
| | **Clinical choriamnionitis** | 0.824 | 0.869 | 0.252 | 2.997 |
| | **MV after 3 dol** | 0.316 | 9.271 | 0.119 | 722.763 |
| | **MV first 3 dol** | 0.242 | 10.45 | 0.204 | 534.481 |
| | **Nosocomial infection** | 0.148 | 0.238 | 0.034 | 1.666 |
| | **PDA** | 0.433 | 2.154 | 0.316 | 14.664 |
| | **Abnormal prenatal ultrasound** | 0.255 | 2.379 | 0.535 | 10.569 |
| | **Total duration MV (hs)** | 0.497 | 1 | 0.999 | 1.002 |
| | **GA (weeks)** | **0.014** | 0.249 | 0.082 | 0.752 |
| **26 to 29 WGA** | **Antenatal steroids** | **0.004** | 3.447 | 1.481 | 8.019 |
| | **Clinical choriamnionitis** | 0.84 | 1.098 | 0.444 | 2.713 |
| | **MV after 3 dol** | **0.003** | 9.726 | 2.217 | 42.67 |
| | **MV first 3 dol** | **0.001** | 10.452 | 2.544 | 42.953 |
| | **Nosocomial infection** | 0.889 | 1.067 | 0.427 | 2.667 |
| | **PDA** | 0.689 | 0.839 | 0.356 | 1.98 |
| | **Abnormal prenatal ultrasound** | 0.137 | 1.951 | 0.808 | 4.715 |
| | **Total duration MV (hs)** | **0.001** | 1.003 | 1.001 | 1.004 |
| | **GA (weeks)** | **0.033** | 0.608 | 0.384 | 0.961 |
| **29 to 32 WGA** | **Antenatal steroids** | 0.406 | 1.786 | 0.454 | 7.021 |
| | **Clinical choriamnionitis** | 0.98 | 0.976 | 0.147 | 6.49 |
| | **MV after 3 dol** | 0.193 | 4.122 | 0.488 | 34.799 |
| | **MV first 3 dol** | **0.004** | 7.544 | 1.884 | 30.215 |
| | **Nosocomial infection** | 0.471 | 1.549 | 0.471 | 5.089 |
| | **PDA** | **0.014** | 5.603 | 1.422 | 22.075 |
| | **Abnormal prenatal ultrasound** | **< 0.01** | 8.737 | 2.602 | 29.336 |
| | **Total duration MV (hs)** | **0.06** | 1.005 | 1 | 1.011 |
| | **GA (weeks)** | **0.017** | 0.423 | 0.209 | 0.858 |

## ABS 130

## OUTCOME OF INFANTS BORN AFTER MID-TRIMESTER RUPTURE OF MEMBRANES

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### INTRODUCTION

Mid-trimester rupture of membranes (MTROM) occurs between 12-24 weeks gestation and it is affecting 0.1-0.7% of all pregnancies. MTROM is known to be associated with significant foetal and neonatal morbidity and mortality. Infants born after MTROM are at risk of pulmonary hypoplasia, early onset infection and other complications of preterm birth. Chorioamnionitis and the duration of oligohydramnios are associated with worse outcome. However, there is a lack of contemporary data since improvements in ventilation strategies, improved use of antenatal steroids, and the use of inhaled nitric oxide (iNO) leading to prognostic uncertainty.

### METHODS

We conducted a retrospective cohort study. We included patients exposed to MTROM from January 2008 to December 2013 who were born after 23 weeks and six days of gestation and admitted to the neonatal intensive care unit in Coombe Women and Infants University Hospital, Dublin, Ireland. Major congenital malformation was the only exclusion criterion. A retrospective chart review identified 51 eligible patients, for whom further data was collected. The primary outcome was survival to discharge. Our secondary outcomes included pre-specified neonatal morbidities. For statistical analysis, independent t-test was used for comparison of means and Chi-

**Table 1 (ABS 130).** Mid-trimester rupture of membranes (MTROM).

| Descriptive variable | | Overall | Survivors (n = 40) | Non-survivors (n = 11) | p-value |
|---|---|---|---|---|---|
| Antenatal factors | Maternal age (years) | 31.2 (5.5) | 30.7 (5.65) | 32.7 (4.49) | 0.144 |
| | Age > 35 years | 10 (20%) | 8 (20.5%) | 2 (18%) | 0.89 |
| | ANS (complete) | 46 (90%) | 36 (90%) | 10 (90%) | 0.93 |
| Delivery | GA at ROM (days) | 143 (18) | 144 (17.7) | 140 (18.7) | 0.51 |
| | GA at birth (days) | 194 (29) | 200 (30.1) | 175 (9.6) | 0.14 |
| | Duration of latency (days) | 51 (34.1) | 56 (35.1) | 36 (21.8) | 0.08 |
| | Birthweight (g) | 1,174 (670) | 1,283 (707) | 778 (251) | 0.03 |
| | Male sex | 28 (57%) | 25 (62.5%) | 4 (36%) | 0.12 |
| | Apgar < 3 (1 minute) | 15 (29%) | 9 (22.5%) | 6 (54.5%) | 0.04 |
| | Apgar < 3 (5 minutes) | 5 (10%) | 2 (5%) | 3 (27%) | 0.03 |
| | Mean CRIB Score | 7 (5.08) | 6 (4.8) | 12 (3.24) | < 0.001 |
| | Mean CRIB II Score | 10 (5.76) | 9 (5.6) | 15 (2.98) | < 0.001 |
| Ventilation | Surfactant | 41 (80%) | 30 (75%) | 11 (100%) | 0.09 |
| | Vent required | 45 (88%) | 34 (85%) | 11 (100%) | 0.32 |
| | Days vent (mean) | 13.4 (21) | 15.4 (23.2) | 6.1 (6.2) | 0.19 |
| | iNO | 21 (41%) | 16 (40%) | 5 (45.5%) | 0.74 |
| | Inotropes | 25 (49%) | 15 (37.5%) | 10 (91%) | 0.002 |
| PDA | PDA | 37 (72.5%) | 26 (65%) | 11 (100%) | 0.02 |
| Sepsis | EOS | 13 (25.5%) | 8 (20%) | 5 (45%) | 0.09 |
| | BC positive | 1 (2%) | 1 (2.5%) | 0 | 1 |
| | LOS | 18 (35%) | 15 (37.5%) | 3 (27%) | 0.52 |
| | BC positive | 11 (21.5%) | 8 (20%) | 3 (27%) | 0.62 |
| Chronic lung disease | CLD at 28/7 | 22 (43%) | 22 (55%) | 0 | N/A |
| | CLD at 36/40 | 17 (33%) | 17 (42.5%) | 0 | N/A |

Proportions are presented as n (%); continuous data are presented as mean (SD).

squared test for proportions. Level of significance was set at $p < 0.05$.

RESULTS

Of the 51 patients identified, 40 (78%) survived to discharge. The cohort surviving to discharge had higher birth weight (1,283 ± 707 g vs 778 ± 251 g, $p < 0.03$), lower CRIB II scores (9 ± 5.6 vs 15 ± 2.98 g, $p < 0.001$), and better Apgar scores. No differences between survivors and non-survivors were identified in sex, gestational age at ROM or exposure to antenatal steroids. Forty five (88%) patients required invasive ventilation. Twenty one (41%) of patients required iNO. Twenty six (51%) patients had PPHN diagnosed on echocardiogram, which was associated with increased mortality. Of those surviving to discharge, 17 (42%) of patients had chronic lung disease (defined as oxygen requirements at 36 weeks corrected age). All infants discharged from the hospital survived to 12 months of age. Results are shown in **Tab. 1**.

CONCLUSIONS

This study provides contemporary data on neonates alive at birth following exposure to MTROM in a jurisdiction with limited access to termination of pregnancy. Despite recent advances in neonatal care, MTROM is still associated with high mortality and morbidity. While the difference in latency period was not statistically significant, associated features of later delivery including higher birth weight and lower CRIB I/II score were associated with improved outcomes.

## ABS 131

## NEURALLY ADJUSTED MECHANICAL VENTILATION (MV-NAVA) IN THE NEWBORN

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INTRODUCTION

Neurally adjusted ventilatory assist (NAVA) is a ventilatory mode that uses diaphragmatic electrical activity (Edi) to synchronize and give the patient proportional assistance to their respiratory effort. Our aim is to describe the clinical characteristics, respiratory parameters and comfort of patients ventilated with MV-NAVA in our unit.

METHODS

This is a retrospective review of medical records. We included newborns that received MV-NAVA in our unit during a 2 years period (Jan 2015-Feb 2017). General variables, respiratory parameters during the first 7 days of MV-NAVA and prior to withdrawal (NAVA Level, peak and minimum Edi, respiratory rate, PIP, MAP, PEEP, oxygen and $PCO_2$) and early morbidity data were collected.

RESULTS

N = 12. BW 455-3,330 g (median 1,094 g), GA 24.4-39.6 w (median 28.5 w). 66.7% male. 58.3% (7/12) preterms, 41.7% (5/12) congenital diaphragmatic hernia (HDC). All patients had prior conventional ventilation, duration 11-98 d (median 46.8 d); 33% (4/12) with previous extubation failure. MV-NAVA onset age 5-70 d (median 34 d), median duration 2.5 d (0.2-23 d). Maximum NAVA level was 2.2 ± 1.4 $\mu V/cmH_2O$, reached at a median of 1 h (1-168 h). 61.5% (8/12) had clinical improvement and better synchronization, greater comfort in 53.8% (7/12) according to clinical observation. In 16.7% (2/12) an adequate Edi signal was not obtained (HDC with left hemidiaphragmatic agenesis, absence of central respiratory effort). 2 patients died before extubation. 66.6% (8/12) were extubated, 87.5% (7/15) to NIV-NAVA, all succeed. Median extubation age 61 d(11-106 d). 75% (11/15) had severe BPD, hospital stay 30-166 d (median 109 d). 41.7% (7/15) home oxygen. Results are presented in **Tab. 1**.

CONCLUSIONS

MV-NAVA is a ventilatory mode applicable in the newborn in our environment. It allows better synchronization in MV, with greater comfort for the patient, as well as a proportional assistance that seems to lead to a better clinical outcome.

**Table 1 (ABS 131).** Ventilation data.

| | MV-NAVA |
|---|---|
| NAVA level ($\mu V/cmH_2O$) | 2 ± 0.6 |
| Peak Edi (μV) | 7-13 |
| Minimum Edi (μV) | 0.6-2.2 |
| Minimum PIP ($cmH_2O$) | 18.8 ± 4.8 |
| Maximum PIP ($cmH_2O$) | 21.6 ± 4.5 |
| Minimum MAP ($cmH_2O$) | 9 ± 2 |
| Maximum MAP ($cmH_2O$) | 11 ± 2 |
| Minimum Respiratory Rate (rpm) | 43.4 ± 11.2 |
| Maximum Respiratory Rate (rpm) | 55.5 ± 9.7 |
| Minimum Tidal Volume (cc/kg) | 6.4 ± 3.1 |
| Maximum Tidal Volume (cc/kg) | 9.5 ± 5 |
| $iFO_2$ | 0.36 ± 0.15 |
| $pCO_2$ (mmHg) | 54.2 ± 9.8 |

Results expressed as mean ± standard deviation or median.
NAVA: neurally adjusted ventilatory assist; Edi: diaphragmatic electrical activity.

## ABS 132

## CHYLOTHORAX: CASE SERIES OF 20 YEARS

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### INTRODUCTION

Chylothorax is a relatively uncommon condition defined as the accumulation of lymphatic fluid in the pleural space. It may be either congenital or acquired due to thoracic surgery. In congenital chylothorax persistent chylous pleural effusion may impair lung development in the fetus and ventilation in the neonate leading to severe respiratory disease. Chylothorax in infants is associated with significant morbidity, including respiratory compromise, malnutrition, immunodeficiency, and infection. The aim of this study was to evaluate the number of infants diagnosed with chylothorax admitted to the NICU of a Portuguese tertiary hospital in the last 20 years, its main causes and treatment.

### METHODS

We retrospectively reviewed the medical records of all infants diagnosed with chylothorax from 1997 and May 2007 at our institution. Data collected included demographics, prenatal and neonatal history, chylothorax type (congenital or iatrogenic) and the primary pathologies associated, need, type and duration of assisted ventilation, chest tube output (CTO), medical and dietary interventions, complications during hospitalization, surgical procedures, clinical evolution and destination at discharge.

### RESULTS

26 neonates (18 males; mean gestational age 35.9 [25-40] weeks) were diagnosed with chylothorax, either congenital (6, 4 of which with prenatal diagnosis of hydrops) or acquired (20) postoperatively (10 with congenital cardiac disease, 5 with esophageal atresia and 5 submitted to surgical correction of diaphragmatic hernia). Mean length of hospital stay was 47 days. One newborn with congenital chylothorax was submitted to pleurodesis and another to thoracic channel lacquering. In 24 newborns, drainage with a chest tube was necessary (mean 28.5 days if congenital and 15 days if acquired), 13 were treated with octreotide (3 of the congenital ones) and 16 were fed with medium-chain triglycerides (3 of the congenital). During hospitalization, 24 needed assisted ventilation and all had antibiotics. 6 patients did not survive.

### CONCLUSIONS

Chylothorax is a rare condition with no standardized treatment recommendations. Caring for a neonate with chylothorax requires a multidisciplinary approach. The majority of chylothorax at our institution were secondary to surgical interventions to correct predominantly congenital heart disease. The child's hospital stay was lengthy and therefore the impact on the child, family and hospital resources was significant.

## ABS 133

## NEONATAL CHYLOTHORAX: 20 YEARS EXPERIENCE IN A TERTIARY NEONATAL UNIT

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### INTRODUCTION

Neonatal chylothorax (NC) is a rare but life-threatening condition characterised by lymphatic fluid accumulating in the pleural cavity, and can be of congenital or iatrogenic origin. It can cause significant respiratory morbidity, as well as lead to malnutrition and immunodeficiency. Currently there are no standardised, approved guidelines for its management. Therapeutic modalities include prenatal or postnatal pleural drainage, diet modification, octreotide therapy, with surgery reserved for refractory cases. This study aims to review the underlying aetiology, clinical course, management and outcome of infants with congenital chylothorax admitted to a tertiary level neonatal unit.

### METHODS

The medical records of all neonates admitted to our institution with a diagnosis of chylothorax over the period from 1997 to 2017 were reviewed retrospectively. Outcomes evaluated included chest drain output and duration, ventilation requirement, time to full enteral feeds and length of hospital stay.

### RESULTS

25 NC cases were identified. Aetiology and outcomes appear on **Tab. 1**. 14 were diagnosed antenatally and 6 had antenatal pleural-drainage. All cases required pleural-drainage postnatally for 25.4 (10-58) days.

**Table 1 (ABS 133).** Aetiology and outcomes of chylothorax cases.

| Aetiology | n (%) | Required surgery | Discharged home | Death |
|---|---|---|---|---|
| Idiopathic | 14 (56%) | 2 | 14 | 0 |
| Iatrogenic | 6 (24%) | 0 | 4 | 2 |
| Genetic disorder | 5 (20%) Trisomy 21: 4 Noonan's: 2 | 0 | 4 | 1 |

No difference was noted in outcome between groups according to aetiology, though those with a genetic cause had a larger drain output. 1 baby was discharged on breast-feeding whilst 20 required a MCT (medium-chain triglyceride) formula. 17/25 (68%) were trialled on breast-milk, however in all cases this was discontinued after 11.2 (1-70) days due to recurrence or worsening of chylothorax. 11 babies were treated with octreotide, commenced at 14.8 (8-27) days and continued for 28.4 (3-52) days (dose range: 1-10 mg/kg/h). Of these 5 were successful at reducing drain output, whilst 4 were equivocal and 2 resistant to treatment. 2/25 infants underwent surgery for chylothorax, while 3/25 died.

CONCLUSIONS

The majority of infants survived, with all requiring prolonged periods of intensive-care. Trials of EBM were unsuccessful with most infants being discharged on MCT. Octreotide had varied success. This is of value in counseling parents and planning care for these infants. Data from multi-centre cohorts would help develop evidence-based stepwise treatment strategies.

## ABS 134

## *IN VITRO* ANALYSES OF GASTRIC ASPIRATES FROM PRETERM NEONATES AFTER CORTICOSTEROID THERAPY

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INTRODUCTION

Neonatal respiratory distress syndrome is a relatively common condition resulting from insufficient production of alveolar surfactant that occurs in preterm neonates and often has a lethal outcome. In order to determine the infants' lung maturity we investigated the surface properties of gastric aspirates from prematurely born infants after application of corticosteroid therapy 24 hours before birth, and full-term children.

METHODS

The pendant drop method allows the determination of the surface characteristics of small aliquots (only 50 μl) of the gastric aspirate: equilibrium surface tension in static conditions, and maximal and minimal surface tension during compression/decompression cycles. In addition, by using a Brewster angle microscope, spread Langmuir films from gastric aspirates at air-water interface were visualised in real-time.

RESULTS

The gastric aspirates of preterm neonates after corticosteroid therapy had similar equilibrium and maximal and minimal surface tension values, compared to the full-term infants. Our results showed that corticosteroid therapy is useful in the treatment of prematurely born babies for their normal lung development.

CONCLUSIONS

Our study proved that the surface tension measurement and the study of surface morphology using small volume of gastric aspirates could be used in the clinical practice as rapid and reliable methods for estimation of neonatal surfactant maturity immediately after delivery. Based on our results we suggest a rapid and convenient approach for assessment of lung maturity, which could be introduced into clinical practice.

ACKNOWLEDGEMENTS

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## ABS 135

## WHICH NASAL CPAP SYSTEM TO USE IN PRETERM NEWBORNS WITH RESPIRATORY DISTRESS SYNDROME

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INTRODUCTION

Nasal Continuous Positive Airway Pressure (Nasal CPAP) is noninvasive treatment of Neonatal Respiratory Distress Syndrome (RDS). Aim: to study effect of different nasal CPAP techniques on length of CPAP stay, CPAP failure, complications and mortality, length of oxygen treatment and Neonatal Intensive Care Unit stay.

METHODS

A prospective randomized study between January 2012 and December 2014, involved 200 infants with gestational age (GA) 28-35 weeks, treated for RDS. They were assigned to Bubble NCPAP (n = 100) and Biphasic NCPAP (Infant Flow) (n = 100), using short bi-nasal prongs. The characteristics registered were: gender, way of delivery, gestational age, birth weight, Apgar score at 1st and 5th minute, need for resuscitation, antenatal corticosteroids and surfactant use. Length of CPAP stay, CPAP failure, complications, incidence of air leaks, incidence of intraventricular hemorrhage (IVH) and persistent ductus arteriosus (PDA), pneumonia, nasal lesions, gastric distension and mortality related to nasal CPAP technique, length of oxygen treatment and Neonatal Intensive Care Unit stay, were outcomes measured.

RESULTS

Newborns in 2 groups had similar characteristics (gender, way of delivery, gestational age, birth weight, Apgar score, corticosteroids, surfactant use); $p > 0.05$. CPAP failure was found 20/100 in Bubble CPAP vs 20/100 in Infant Flow CPAP, pneumothorax 4/100 vs 4/100, IVH 12/100 vs 11/100, PDA 19/100 vs 18/100, mortality rate 8/100 vs 10/100 ($p > 0.05$); similar length of oxygen treatment and Neonatal Intensive Care Unit stay 10.65 ± 1.06 vs 16.67 ± 1.67 ($p = 0.093$). Nasal lesion was present in 31/100 newborns in Bubble NCPAP vs 7/100 newborns in Infant Flow NCPAP ($p < 0.001$), pneumonia 15/100 in Bubble NCPAP vs 28/100 in Infant Flow NCPAP ($p = 0.025$), length of CPAP stay in Bubble NCPAP was 2.08 ± 1.58 vs 3.24 ± 2.92 in Infant Flow NCPAP ($p = 0.001$). These were the outcomes with statistically significant difference.

CONCLUSIONS

Most of long-term and short-term outcomes were comparable in two nasal CPAP techniques. The decision which nasal CPAP to use should be made based on staff's familiarity with the device and its cost.

## ABS 136

## PREDICTIVE AND RISK FACTORS FOR EARLY NON-INVASIVE RESPIRATORY SUPPORT FAILURE IN A COHORT OF PRETERM INFANTS: A RETROSPECTIVE STUDY

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INTRODUCTION

Neonatal RDS is associated with high morbidity and mortality in preterm infants. However, over the last decades, the introduction of surfactant therapy has dramatically changed preterm neonates survival, in addition to significant improvements in ventilation strategies. Current recommendations advocate rescue treatment and criteria for administration are based on gestational age and $FiO_2$ requirement. New methods for delivering surfactant have been recently introduced in clinical practice to reduce exposure to mechanical ventilation. However, the efficacy of non-invasive respiratory support (NRS) is closely related to gestational age, with NRS failure rates in very low birth weight infants ranging from 20 to more than 50%. For this reason, we investigated which factors influenced the NRS failure in order to optimize surfactant administration.

METHODS

We retrospectively collected data of 167 premature neonates ($23^{+0}$-$30^{+6}$ weeks' GA) admitted to two Italian NICUs in 2011-2016. Infants were stratified in two groups, according to their need for respiratory support. At birth (T0), if intubated they were classified as "severe" (S), if on NRS they were rated as "marginal" (M). The clinical evolution was further assessed according to this classification at 24 hours of life (T1) (i.e. MM: Moderate-to-Moderate, or MS: Moderate-to-Severe). Statistics included logistic regression and classification tree analysis to explore differences among groups at T0 and T1.

RESULTS

At T0 Marginal group (n = 96) mean BW was 952 g (SD 255), mean GA was $27^{+4}$ (SD 8 d). At T1 MM group (n = 73), MS group (n = 21) and two babies were in spontaneous breathing (**Fig. 1**).

Statistical analysis showed that risk factors for early NRS failure are:

- maternal diseases during pregnancy (OR: 3.16; 95% CI 1.25-9.03; $p < 0.001$);
- low Apgar score at 10 min (0.28; 0.09-0.74; $p < 0.001$);

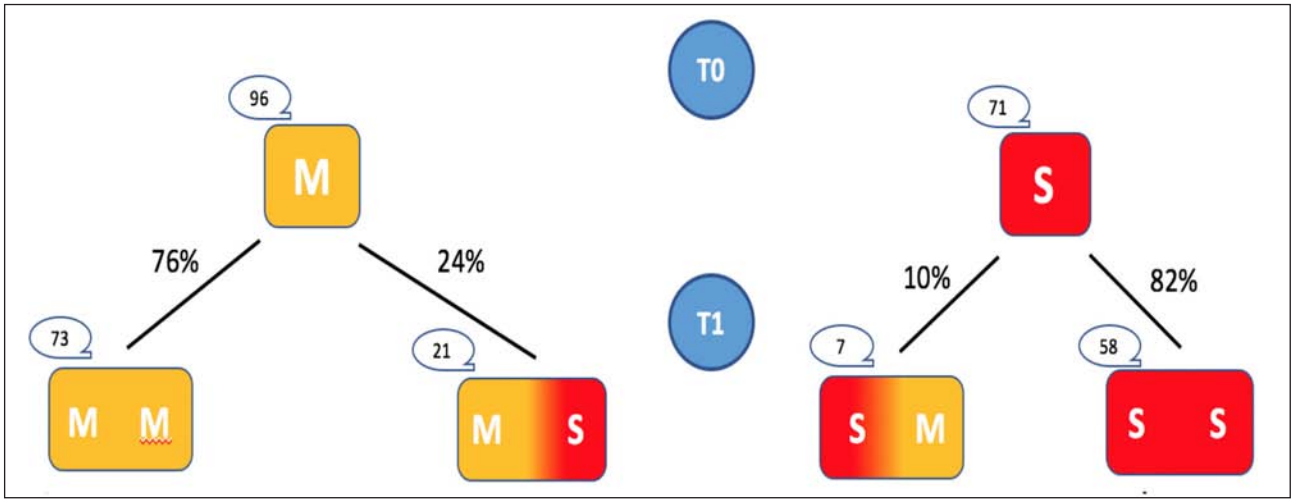


**Figure 1 (ABS 136).** Classification of preterm infants based on different need for respiratory support at birth (T0) and at 24 hours of life (T1).
M: marginal; S: severe.

- low BW/GA (OR: 0.09; 95% CI 0.99-0.09; p < 0.02);
- lack of sustained inflation maneuver (Risk Ratio 0.31; 0.15-0.66; p = 0.006).

Predictive factors for NRS failure after classification tree analysis are mode of delivery, gender, IUGR, Apgar score at 1 min, BW and GA. Mean number of surfactant administration needed during the whole stay in NICU in MM group was 1 vs 2 in MS group (p2, IVH > 2, PVL) compared to MS population ($X^2$ = 14.72, p < 0.001).

CONCLUSIONS

Our data underline the well known multifactorial origin of NRS failure and the importance of considering all these factors as a whole. Not surprisingly, MS group showed worse respiratory and neurological outcomes, confirming the need to avoid mechanical ventilation. Given the need for a higher number of surfactant administration in MS group, we speculate that using clinical standard criteria for surfactant administration could be further explored, in order to reduce NRS failure rate and therefore long term sequelae.

## ABS 137

## MEASURING OXYGEN DIFFUSION AT 36 WEEKS' PMA IN PRETERM INFANTS: ANALYSIS OF THE $SatO_2/FIO_2$ RATIO AND ITS CORRELATION WITH EARLY RESPIRATORY PATTERNS OF DISEASE

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INTRODUCTION

Bronchopulmonary dysplasia (BPD) can be graded depending on $FIO_2$, $SatO_2$ and respiratory support at 36 weeks [1]. Limited data exist on preterm infants without BPD who also experience various degrees of lung impairment in later life [2]. We recently described 4 early patterns of lung disease associated with different prevalence of BPD ($LowFIO_2$, Pulmonary Improvement [PI], Pulmonary Deterioration [PD], Early Persistent Pulmonary Deterioration [EPPD]) [3]. In the present study, $O_2$ diffusion at 36 weeks' PMA was analyzed in preterm infants admitted at a regional NICU by means of the noninvasive $SatO_2/FIO_2$ ratio (SFR), and predictors of the SFR were investigated.

METHODS

Retrospective study with infants born < 31 weeks' GA admitted between Jan 2004-Dec 2015. Data were recorded according to predefined criteria. Early patterns of lung disease were: $LowFIO_2$, i.e. $FIO_2$ < 0.23 on all days between 3 and 7 postnatal days and ≤ 0.25 on day 14; PI, i.e. $FIO_2$ ≥ 0.23 on all days between 3 and 7 postnatal days and ≤ 0.25 on day 14; PD, i.e. $FIO_2$ 0.25 on day 14; EPPD, i.e. $FIO_2$ ≥ 0.23 on all days between 3 and 7 postnatal days and > 0.25 on day 14. SFR was the ratio between median $FIO_2$ and median $O_2$ saturation at 36 weeks' PMA. We described median values and interquartile range, and compared SFR between groups (Mann-Whitney test, Kruskal Wallis test as appropriate) and performed a multiple regression analysis to find predictors of SFR.

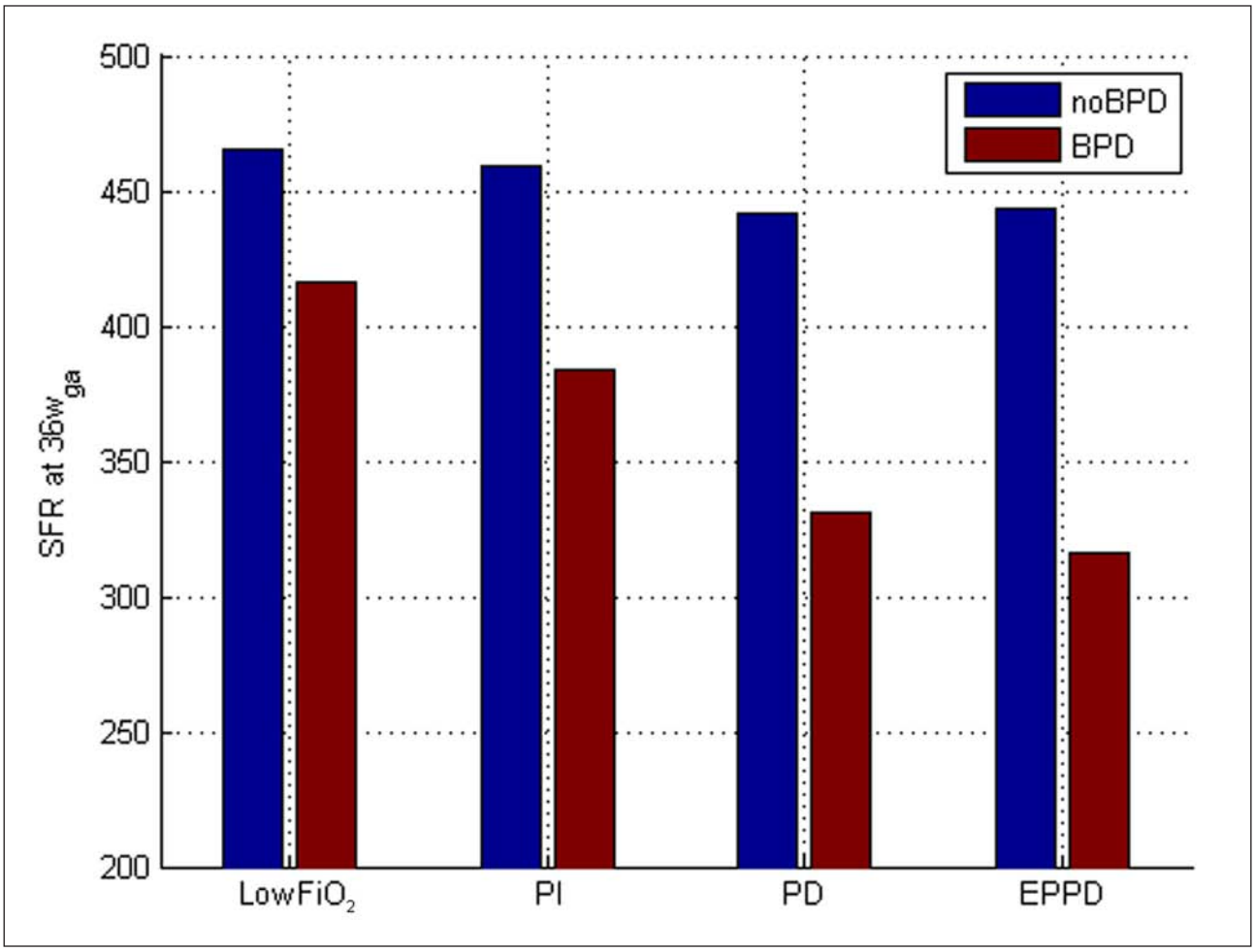


**Figure 1 (ABS 137).** SFR (the ratio between median $FIO_2$ and median $O_2$ saturation at 36 weeks' Post Menstrual Age) in 4 early patterns of lung disease associated with different prevalence of BPD ($LowFIO_2$, Pulmonary Improvement [PI], Pulmonary Deterioration [PD], Early Persistent Pulmonary Deterioration [EPPD]).

## RESULTS

932 infants < 31w GA were born in the study period: 711 were analyzed (109 died, 25 had major malformations, 58 late admissions, 29 unavailable data). Median GA was $28^{+6}$ w ($24^{+0}$ - $30^{+6}$), median birth weight 1,081 g (380-2,245); 365 (51.3%) were male, 127 (17.8%) had BPD. There were 373 (52.5%) $LowFIO_2$, 212 (29.8%) PI, 71 (10%) PD, 55 (7.7%) EPPD. Median SFR was 465 (447.6-471.4). SFR was significantly different between BPD and non-BPD infants (362 [317-410] vs 467 [460-472], p = 0.000), and according to the early lung pattern: $LowFIO_2$ 471 (462-476), PI 467 (448-471), PD 413 (340-457), EPPD 365 (310-457), p = 0.000. Multiple regression analysis ($r^2$ = 0.277) showed that sex (M, B = -16.6, p = 0.017), birth weight (B = 0.061, p = 0.001), sepsis (B = -27.9, p = 0.000), surfactant administration (B = -22.6, p = 0.008), prevalent human milk feeding (B = 20.3, p = 0.003) predicted SFR. The SFR distribution is shown in **Fig. 1**.

## CONCLUSIONS

Infants with BPD had worse lung function (assessed by noninvasive SFR) at 36 weeks' PMA compared with non-BPD. Among infants without BPD, there was a wide spectrum of lung function with some degrees of impairment; infants with different patterns of early lung disease had significant differences in SFR at 36 weeks' PMA. Predictors of SFR were sex, birth weight, sepsis, surfactant administration, human milk feeding.

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## ABS 138

## RELIABILITY OF MANUALLY COLLECTED CARDIO-PULMONARY PARAMETERS IN PATIENTS' CHARTS

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### INTRODUCTION

Pulse Oximeter Oxygen Saturation ($SpO_2$) and Fraction of Inspired Oxygen ($FiO_2$) measurements are common practice in NICU. $SpO_2$ is assessed using probes placed on limbs, while $FiO_2$ is measured by gas oximeters. These parameters are read in multiparametric monitors (MM) at the bedside and in mechanical ventilators, and transcribed in patient's charts by caregivers. The reliability of transcribed data may be suboptimal due to many reasons, including nurse workload. Computerized recording and analysis of $SpO_2$ and $FiO_2$ may be more reliable and useful for patients. The aim of this study was to compare manual versus computerized $SpO_2$ and $FiO_2$ recording at our NICU.

### METHODS

We studied 30 randomly selected patients admitted to a regional NICU. $SpO_2$ and $FiO_2$ data were acquired by a MM device (Datascope Passport 2) connected to a $SpO_2$ probe (Masimo-SET) (uncertainty of measure ± 3%) and a Witt oximeter respectively (uncertainty of measure ± 0.1%). All data were synchronously acquired by a portable PC with a sample frequency of 1 Hz and stored in a txt file; mean values and standard deviations were calculated. Each recording lasted 1 hour. Nurses (blind to recorded data) transcribed $SpO_2$ and $FiO_2$ data on patients' charts hourly. Computerized recordings were compared with manual transcripts by paired T-test. A Bland Altman Plot was produced to compare the two measurement techniques. ANOVA was conducted to find out differences between patients.

### RESULTS

739 samples of $SpO_2$ and $FiO_2$ data were collected by caregivers from 30 patients, and 2.5 millions of $SpO_2$ and $FiO_2$ data were simultaneously acquired by a PC. Paired T-test analysis showed that manually collected $SpO_2$ data were underestimated (Manual 90.56%, SD 3.36 vs Auto 91.53% SD 3.14% p = 0.000). The Bland Altman Plot is presented in **Fig. 1**. ANOVA showed similar differences in all the analysed patients (p = 0.647). The same was evident for $FiO_2$ data, which were underestimated by manual transcription: manual 24.12% SD 7.91% vs Auto 24.69% SD 5.41%, p = 0.000). ANOVA showed similar differences in all the analysed patients (p = 0.647). The magnitude of the manual underestimation was low; however, in 20% of patients, the mean difference between automatic vs manual $SpO_2$ and $FiO_2$ data exceeded 4%.

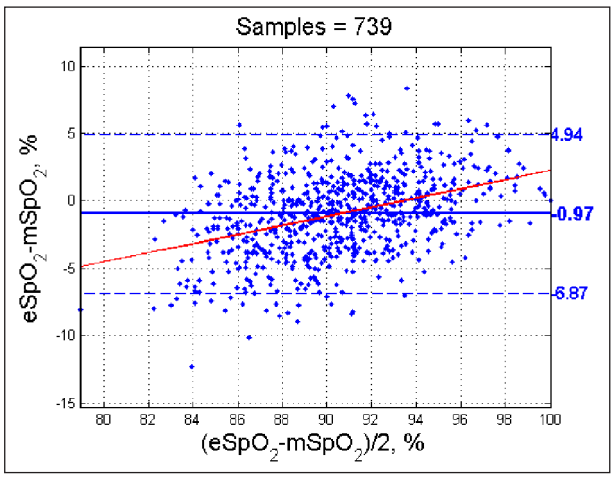


**Figure 1 (ABS 138).** The Bland Altman Plot.

### CONCLUSIONS

We found a small yet significant difference in automatic versus manual $SpO_2$ and $FiO_2$ recordings: nurses tended to underestimate the real values. This could have important implications in changing clinical decisions and diagnosis about patient care (i.e. therapies, diagnosis of BPD). Computerized recording and analysis of $SpO_2$-$FiO_2$ may be achieved with low-cost equipment, at least in selected patients or in particular aspects of patient care.

## ABS 139

## ASSESSMENT OF CARDIO-RESPIRATORY RATES BY NON-INVASIVE MEASUREMENT METHODS IN HOSPITALIZED PRETERM NEONATES

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## INTRODUCTION

Respiratory rate (RR) and heart rate (HR) monitoring in infants is essential to assess health status and allows the diagnosis of several disorders. Current monitoring technology is based on contact devices, used for prolonged time periods in preterm infants, which may exert pressure to the skin resulting in tissue compression, vascular insufficiency and potential skin breaks. A reliable non-contact monitoring system might avoid these complications, improve patients' comfort, and have potential applications for remote home monitoring. We present our experience with a novel contactless monitoring system applied to preterm and term infants admitted to a regional NICU.

## METHODS

A non-contact measurement system based on a video camera (CCD; 1,280 x 720 pixels; frame rate 30 fps) was installed close to the patient to record the thorax. As a reference for HR and RR we use a multi-parameter monitor (MM-Datascope Passport 2) connected to a PC. A light source positioned above the patient helped avoiding optical artifacts and improving video quality. Data from the CCD and the MM were synchronously acquired and analyzed offline using Matlab software. We studied 12 patients, including 1 with ichthyosis. CCD-HR and RR were compared to MM-HR and RR by Pearson's correlation and Mann Whitney paired test. Uncertainty was estimated by GUM. ANOVA was run to find out differences between subjects. A Bland Altman Plot was produced to compare the 2 measurement techniques.

## RESULTS

HR resulting from the CCD image analyzer and MM were similar: 162 vs 165 bpm, p = 0.101; Pearson's correlation coefficient $R^2$ was 0.657 (p = 0.758); uncertainty was estimated to be 8.3 bpm with a coverage factor k = 2. RR resulting from the CCD image-analyzer and MM were similar as well: 31 vs 33 rate/min, p = 0.678 (Pearson correlation $R^2$ = 0.798, p = 0.902); uncertainty was estimated to be 4.1 rates/min with coverage factor k = 2. ANOVA test was applied to residuals and showed no significant difference between subjects (p = 0.178 and p = 0.659 for HR and RR respectively). The Bland Altman plot is shown in **Fig. 1**.

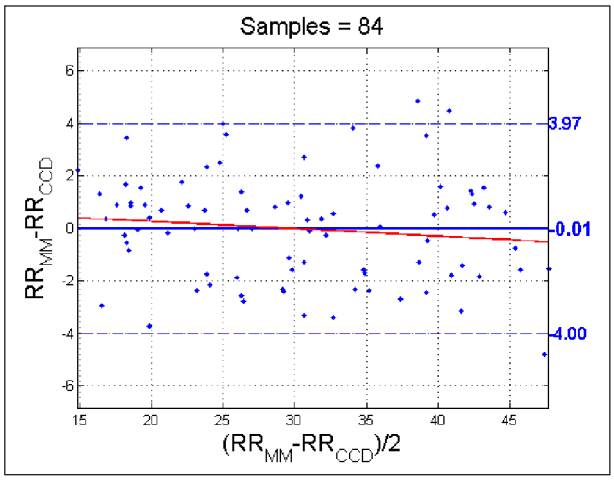


**Figure 1 (ABS 139).** The Bland Altman plot.

## CONCLUSIONS

A contactless method for HR and RR monitoring might be an alternative to traditional devices. Potential limitations are connected with light/ambient artifacts and motion artifacts (non-collaborative patients), which can reduce the chest view and temporarily prevent the measure. This technique might be helpful also for patients with congenital skin disorders, as contact monitoring in these situations could be technically difficult or hazardous.

## ABS 140

## RESPIRATORY DISTRESS SYNDROME: GENETIC POLYMORPHISM OF GENES ENCODING SURFACTANT PROTEIN B AND XENOBIOTIC BIOTRANSFORMATION ENZYMES

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## INTRODUCTION

The most common cause of respiratory disorders in infants is respiratory distress syndrome (RDS). Polymorphic variants of genes encoding surfactant proteins can result in pulmonary morbidity in newborn infants. In addition, the change in the activity of xenobiotic biotransformation enzymes associated with the presence of genetic polymorphism can

lead to an increased susceptibility of the organism to adverse effects and, as a consequence, to an increased risk of respiratory diseases. That's why it is necessary to consider the overall contribution of genetic factors for determining predisposition to respiratory disorders in premature newborns. Objectives. To examine polymorphic variants of the gene encoding surfactant protein B (SFTPB) and the genes encoding xenobiotic biotransformation enzymes (GSTP1, NAT2) in premature newborns with RDS in Belarus.

METHODS

76 preterm infants with RDS, gestation age 27-36 weeks, treated with poractant alfa were under the study. 49 healthy term newborns were included into the control group. Molecular analyses have been performed on genomic DNA extracted from umbilical cord blood and venous blood. PCR-RFLP method was used to study polymorphic variants of the genes: GSTP1(313A>G, rs1695), NAT2 (481C>T, rs1799929; 590G>A, rs1799930; 857G>A, rs1799931), MDR1(1236C<T, rs1128503; 3435C<T, rs1045642). Polymorphisms of gene SFTPB were detected by using direct sequencing method. The association of genotypes with predisposition to respiratory disorders was estimated by computing odds ratio (OR) and 95% confidence interval (CI). Statistical analysis of the material was done using SNPStats program.

RESULTS

The high risk of RDS in premature newborns in Belarus is associated with the carrier of deletion in intron 4 of the gene SFTPB (OR = 19.00; 95%CI: 1.08-33.92; p = 0.025) (**Fig. 1**). Genotypes 481CT and 481TT of gene NAT2 significantly increase the risk of the development of RDS (OR = 3.35; 95%CI: 1.29-8.74; p = 0.012). In the group of preterm neonates with RDS, the carriers of the homozygous genotype 313GG, which leads to a decrease in the level of the GSTP enzyme in the lungs, were detected 2 times more often than in the control group. In **Fig. 1**, VNTR-repeats in 4 intron of gene SFTPB in newborns with RDS and control group are presented.

CONCLUSIONS

The SFTPB gene deletion can be one of the factors in the development of RDS in premature newborns in Belarus. The study of the genetic polymorphism of xenobiotic biotransformation enzymes has shown the influence of polymorphic variants of the NAT2 gene on the risk of respiratory disorders in premature newborns.

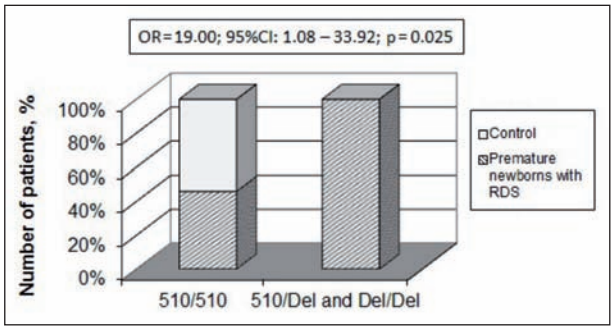


**Figure 1 (ABS 140).** VNTR-repeats in 4 intron of gene SFTPB in newborns with respiratory distress syndrome (RDS) and control group.