ID: 293

TITLE: IN VITRO PERFORMANCE CHARACTERIZATION OF THE CUSTOMIZED EFLOW NEOS NEBULIZER SYSTEM WITH PORACTANT ALFA UNDER SIMULATED RESPIRATORY DISTRESS TIDAL BREATHING THROUGH A REALISTIC NEONATAL UPPER AIRWAY REPLICA

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CONTENT:

Aerosol lung deposition is dramatically reduced in preterm infants due to their breathing pattern and to the narrow cross-section of the airways and ventilation interfaces. Our aim was to determine, in addition to aerosol particle size distribution (PSD) and respirable fraction (RF), the in vitro performance of a customized eFlow Neos vibrating-membrane nebulizer system on undiluted surfactant (poractant alfa, 80 mg/ml) lung deposition when using different clinical neonatal non-invasive ventilation patient interfaces.

Surfactant PSD and RF in presence of different prongs were investigated by laser-diffraction and Next Generation Impactor. Breath simulation studies were conducted in an experimental set-up consisting of a humidified CPAP circuit (5 cmH2O, 5 L/min), the nebulizer, placed between the Y-piece and the ventilation interface (nasal mask or prongs), a preterm upper-airway 3D model (PrINT model, infant of 32 wks gestation and 1.75 kg birth weight), and a breath simulator (tidal volume 9 ml/kg, and respiratory rate 70/min). Collection filters were placed beyond the PrINT cast to estimate the surfactant lung dose. The lecithin content of the collected surfactant fraction was determined by liquid chromatography-mass spectrometry. A total mass of 350 mg, 200 mg/kg dose, of surfactant was nebulized.

Without any interface the volume median diameter was 3.0 ± 0.1 µm with a RF of 93.7%. Mass median aerodynamic diameter (MMAD) with different prong models ranged from 2.52 to 2.81 µm. Irrespective of the ventilation interface, surfactant lung doses ranged between 10 and 19% (Table 1).

The customized eFlow Neos nebulization of poractant alfa produces reproducible surfactant aerosol characteristics and provides high lung deposition under realistic neonatal conditions in vitro. In particular, a better deposition was obtained with the Size S nasal prongs commercially available from Dräger and Inspiration Healthcare.

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COI: Employment PARI Pharma GmbH
ID: 341

TITLE: EARLY NASAL CONTINUOUS POSITIVE AIRWAY FILURE PREDICTION IN PRETERM INFANTS LESS THAN 32 WEEKS' GESTATIONAL AGE

AUTHORS: Valentina Dell’Orto1, Stefano Nobile 2, Alessio Correani 3, Paolo Marchionni 4, Ilaria Giretti 5, Clementina Rondina 6, Maria Laura Palazzi 7, and Virgilio Paolo Carnielli 8

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CONTENT:

Early Continuous Positive Airway Pressure (CPAP) and surfactant rescue replacement are effective treatments for neonatal respiratory distress syndrome (RDS).

CPAP is frequently the first respiratory support in preterm infants, but some neonates fail and need intubation and surfactant replacement. Demographic and clinical variables associated to CPAP failure may vary among centres.

Objectives: To analysed incidence and factors associated with CPAP failure in preterm infants with respiratory distress syndrome (RDS).

Single centre study. Retrospective evaluation of prospectively defined and collected data. Inclusion criteria were: consecutively admitted preterm infants of 24-31 weeks of gestational age, inborn, not intubated at NICU admission, managed with CPAP as first respiratory support, admitted between January 2004 and December 2017. CPAP failure (CPAP-F) was defined as the need of intubation and surfactant administration in the first 72 hours of life, the infants that were successfully managed with CPAP alone were defined as CPAP successes (CPAP-S). Demographic, respiratory and clinical data associated with CPAP-F were studied by logistic regression analysis.

Results 562 infants met inclusion criteria, 252 (44.8%) were CPAP-F and 310 (55.2%) were CPAP-S. CPAP-F, compared to CPAP-S infants, had lower GA (p=0.001), BW (p=0.019), lower incidence of ANS (p=0.01) and higher incidence of caesarean section (p=0.002). We performed a Decision Tree analysis testing the following variables: FiO2 in the first hours of life, GA, BW, gender, type of delivery, 5’ Apgar. The best predictor of CPAP-F was FiO2 ≥0.23 between 180 and 240 minutes of life. FiO2≥0.23 between 180 to 240 min was strongly associated with CPAP F (AUC 0.86, sensibility 84%, specificity 80%). We obtained ROC curves analysis for the infants 29-31 weeks (AUC 0.90, sensibility 88%, specificity 84%), and 24-28 weeks (AUC 0.84, sensibility 82%, specificity 79%). By logistic regression analysis, FiO2≥0.23 between 180 and 240 min of life was the strongest factor associated with CPAP-F (OR and 95%CI 16.01 [10.34-24.81]).

We found that an FiO2≥23 between 180 and 240 minutes of life is a good predictor for CPAP failure in preterm infants with GA from 24+0/7 to 31+6/7 weeks at birth managed with CPAP as primary respiratory support. The accuracy of this model for higher and lower GA group (24+0/7-28+6/7 weeks’ GA and 29+0/7-31+6/7 weeks GA) could lead to uniform FiO2 threshold criteria for RDS surfactant replacement.
Table 1. Basic population details. Data are given as or n (%) or median [interquartile range]. Chi-square or Fisher, and Mann-Whitney test were used for the statistical analysis. Abbreviations: CPAP: continuous positive airway pressure; CPAP-S: CPAP success group; CPAP-F: CPAP failure group; GA: gestational age; PROM: prolonged rupture of membranes; SGA: small for gestational age.

Table 2. Multivariate logistic regression for CPAP failure examining demographic and clinical data at 24-31 weeks’ GA, at 24-28 and 29-31 weeks’ GA. Abbreviations: GA: gestational age; BW: birth weight; PROM: prolonged rupture of membranes; ANS: Antenatal steroids.

Fig 1 ROC curves for CPAP failure prediction between 180 and 240 minutes of life. ROCs curve plots sensibility and 1-specificity for FiO2 between 180 and 240 minutes of life. Panel A: 24-31 weeks’ GA, sensibility 84% and specificity 80%; Panel B: 24-28 weeks’ GA, sensibility 88% and specificity 84%; Panel C: 29-21 weeks’ GA, sensibility 82% and specificity 79%. AUC: Area under curve

COI: None declared
ID: 381
TITLE: FENTANYL PRE-MEDICATION FOR LESS INVASIVE SURFACTANT ADMINISTRATION
AUTHORS: Dina Sava 1, Liam Willgress 1, Paul Clarke 1
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CONTENT:

Less invasive surfactant administration (LISA) is being increasingly used as an alternative to endotracheal surfactant administration, however the optimal premedication dose and agent for LISA is unclear. We reviewed our unit’s experience with using routine fentanyl sedation for the LISA procedure in the NICU.

Prospective audit using a bespoke data collection proforma completed contemporaneously after each LISA procedure performed on our NICU between June 2018 and February 2019. Our unit guideline recommended a single dose of fentanyl 100 mcg/kg as the standard premedication regime given minimum 5 minutes before LISA, with atropine optional. We reviewed number of babies for whom a single fentanyl dose achieved successful premedication, and incidence of side effects associated with LISA.

Ten babies (5 on nasal high flow, 5 on nCPAP) received pre-medication for LISA at median postnatal age 5 (2-40) hours. Median (range) gestation was 32 (27-37) weeks and birth weight 1700 (775-3520) g. A single fentanyl 100 mcg/kg dose achieved good sedation before LISA in only 5 (50%) babies, though one required naloxone for prolonged apnoea; 4 babies required a second 100 mcg/kg dose before undergoing successful LISA, and LISA was abandoned in lieu of INSURE (Intubate-Surfactant-Extubate) in one due to poor sedation with the standard 100 mcg/kg dose. Overall LISA was deemed successful in 8 (80%) babies (1 abandoned; 1 catheter later presumed misplaced). No baby had fentanyl-induced chest rigidity, and none received or required atropine. Of the nine who had LISA, associated side effects were: bradycardia (<100/min) n=3, desaturation (SaO2 <80%) n=6, apnoea n=4, surfactant reflux n=2.

Fentanyl 100 mcg/kg achieved satisfactory pre-medication before LISA in only 50% of babies. This dose failed to adequately sedate a significant minority (40%), yet caused prolonged apnoea in one baby (10%). Fentanyl may not, therefore, be the ideal pre-medication for LISA. Randomised trials are required to determine the optimal drug and pre-medication regimen for LISA in preterm babies.

COI: N/A
ID: 391
TITLE: EFFECTS OF LESS INVASIVE SURFACANT ADMINISTRATION (LISA) ON NICU COURSE IN THE FIRST WEEK OF LIFE
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CONTENT:

Less invasive surfactant administration (LISA) has been established to reduce the need of intubation and mechanical ventilation and to improve survival rates without bronchopulmonary dysplasia in preterm infants with respiratory distress syndrome (RDS). As in many of these infants mechanical ventilation is avoided during the first days of life, we hypothesize other aspects of NICU care changed as well. The objective of this study was to quantitatively investigate whether NICU care has changed since implementation of LISA, with regard to diagnostic procedures and treatment in the first week of life.

We performed a single centre, historical cohort study in our level III NICU. Infants born at <32 weeks of gestation who received surfactant by LISA (time period: June 2014 - December 2017) were compared to infants who received surfactant after intubation (time period: January 2012 - June 2014). Infants who were intubated in the delivery room because of clinical condition (apnoea, sepsis) were excluded. Outcomes were divided into two groups: diagnostic procedures and treatment in the first week of life. Protocols on blood transfusion, antibiotic treatment and feeding did not change between both periods. Data was collected from electronic patient files and compared by univariate analysis through Students T-test, Mann Whitney-U test, Pearson Chi-Square test or Linear by Linear Association.

LISA and control cohort consisted of n=169 and n=162 infants, respectively. Baseline characteristics did not differ between the groups (Table 1). Compared to controls, LISA patients received a higher total surfactant dose (208 vs.161 mg/kg; p<0.001) and needed multiple gifts more frequently (32.5% vs. 22.8%; p=0.049), but less mechanical ventilation (35.5% vs. 77.8%; p<0.001). They received less X-rays (1.0 vs. 3.0, p<0.001) and blood gas examinations (3.0 vs. 6.0, p<0.001) in the first week. LISA patients received less inotropic drugs (9.5% vs. 19.1%; p=0.012), blood transfusions (24.9% vs. 42.6%, p=0.001), umbilical catheters (37.9% vs. 52.5%, p=0.008) and had shorter duration of antibiotic therapy (3.0 vs. 4.0 days, p<0.001). Moreover, enteral feeding was advanced faster (120 vs. 100 ml/kg/d; p=0.024) and birth weight was regained more often (55.9% vs. 32.8%, p<0.001) at day seven.

Our findings show that the implementation of LISA has changed NICU course of preterm infants with RDS in the first week of life. LISA patients underwent fewer diagnostic and therapeutic procedures, which are associated with a risk of adverse outcomes. Our results underscore the beneficial effect of LISA in preterm infants.

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Table 1 Baseline characteristics of the study population and diagnostic and therapeutic procedures in the first week of LISA group compared to control group. * shows significance (p<0.05). GA = gestational age. MV = mechanical ventilation.

COI: No conflict of interest
ID: 438

TITLE: EVALUATION OF SUCCESS, TECHNICAL QUALITY AND VITAL PARAMETERS IN LESS INVASIVE SURFACTANT ADMINISTRATION (LISA) WITHOUT SEDATIVE PREMEDICATION

AUTHORS: Authors: Ellen de Kort 1,2; Suzanne Kusters 3; Hendrik Niemarkt 1; Carola van Pul 3; Irwin Reiss 2; Sinno Simons 2; Peter Andriessen 1

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CONTENT:

Less Invasive Surfactant Administration (LISA) is a technique in which surfactant is administered via a thin catheter in spontaneously breathing infants on nasal continuous positive airway pressure. As in endotracheal intubation, LISA requires laryngoscopy, which is known to be a very distressing and potentially painful procedure and is frequently complicated by adverse physiological events. However, in contrast to endotracheal intubation, LISA is frequently performed without sedative premedication. Aim of this study was to assess success and technical quality of the procedure and the patient response to LISA without sedative premedication.

Prospective observational study in 86 neonates < 32 weeks’ gestation treated with LISA according to a standardized protocol including atropine but without sedative premedication. Only the first LISA per patient was included. Data collection included patient characteristics, number of attempts needed for a successful procedure, and quality of technical conditions determined with the Viby-Mogensen intubation score. In 37 neonates, heart rate (HR) and oxygen saturation (SpO2) data from 20 minutes before until 30 minutes after start of LISA were collected. Changes in HR and SpO2 compared to baseline, and differences in HR and SpO2 between patients with good versus inadequate technical quality and between success versus failure of the first attempt were calculated.

LISA was successful at the first attempt in 45 patients (52%). Success rates were dependent on caregiver: 29% for residents, 32% for neonatal nurse specialists, 30% for fellows and 72% for neonatologists (p = 0.003). Quality of technical conditions was available for 76 LISAs and was good in 45 procedures (59%). In successful first attempts, good technical quality was significantly more frequent compared to failed first attempts (76% versus 35%, p = 0.001). HR significantly increased compared to baseline but SpO2 did not change significantly (figure 1). Bradycardia < 80/min did not occur and desaturations < 80% occurred in 20 patients (54%). There were no significant differences in HR and SpO2 for patients with good versus inadequate technical quality and for patients with success versus failure of the first attempt.

LISA without sedative premedication led to a low procedural success rate, frequent inadequate technical quality and a high incidence of oxygen desaturations. To improve patient comfort, the use of sedative premedication should be strongly considered. Since maintaining spontaneous breathing is the keystone in LISA, drugs with minimal effect on the respiratory drive should be evaluated. To prevent bradycardia, the use of atropine is recommended.

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COI: None declared
ID: 481

TITLE: EFFECTS OF HELIOX NON-INVASIVE NAVA VENTILATION ON RESPIRATORY FUNCTION OF PREMATURE INFANTS.

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CONTENT:

Use of helium-oxygen mixture (heliox) as a breathing gas can be advantageous due to its unique physical properties such as low density and high CO2 diffusion coefficient. In newborns with various pulmonary pathologies conventional ventilation with heliox has been associated with improvement in oxygenation and selected respiratory parameters. Use of heliox might enhance the effectiveness of non-invasive positive pressure ventilation (NIV) however the knowledge regarding effects of such therapy in neonates is limited. Application of neurally adjusted ventilatory assist (NAVA) allows the synchronization of NIV in premature infants and assessment of the diaphragmatic electrical activity (EaDI).

23 neonates ≤32 weeks gestational age (GA) were enrolled in the study. Patients were eligible for inclusion when on NIV with FiO2>0.25 in the first 72 hours of life (n=12) or ready to extubate after 72 hours of life (n=11). Newborns were ventilated with NIV-NAVA at baseline. Heliox was introduced for 3 hours, followed by 3 hours of air-oxygen, NAVA level was kept constant. Recorded parameters included heart rate (HR), oxygen saturation (SpO2) and cerebral tissue oxygenation (StO2). Selected ventilation parameters as well as electrical activity of the diaphragm (EaDI mean, minimum and maximum) were also acquired. Blood gas analysis was performed in each period of the study. Statistical analysis was completed with ANOVA Friedman’s test and repeated-measures ANOVA.

Mean GA was 29 weeks and mean birth weight was 1396 g. Patients’ clinical condition was stable during the study, HR, SpO2 and blood gas parameters were in the normal range. StO2 and selected respiratory parameters did not differ significantly between the study periods. A trend towards decreased respiratory rate after 60 minutes of heliox (53 vs 47 breaths per minute) did not reach the statistical significance. After 15 minutes of heliox EaDI mean was significantly lower than at baseline (3.4 vs 4.8 μV, p=0.0003). All EaDI measures (min, max and mean) decreased significantly 60 minutes after heliox introduction compared to the baseline (EaDI min 1.3 vs 2.5 μV, p=0.02; EaDI max 5.2 vs 8 μV, p=0.0015; EaDI mean 2.9 vs 4.8 μV, p=0.0003). EaDI mean and max were also lower after 180 minutes of heliox than at baseline (EaDI mean 3.2 vs 4.8 μV, p=0.0003 and EaDI max 5.6 vs 8 μV, p=0.0015).

To our knowledge this is the first report of heliox NIV-NAVA application in the newborn. It seems a safe ventilation mode that is well tolerated by premature infants. Significant decrease in the EaDI suggests that the diaphragmatic workload was reduced during the therapy. Further studies are needed to investigate whether the use of heliox NIV-NAVA might shorten the time of ventilatory support and the risk of its failure.

COI: None declared
APPLICATIONS OF THE HIGH FLOW THERAPY IN NON-TERTIARY NEONATAL CENTERS IN POLAND – A PRELIMINARY REPORT FROM A NATIONAL „WOSP HFNC REGISTRY”

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CONTENT:

High flow nasal cannula therapy (HFNC) has become increasingly popular method of ventilatory support in the newborn. It has been shown to be non-inferior to nCPAP post-extubation. Reports regarding effectiveness of HFNC as a primary ventilatory mode for premature infants are inconsistent. However, most studies have been carried out in tertiary neonatal intensive care units. Currently HFNC seems to be a modality of ventilatory support that is the easiest to use in neonates, especially for staff from non-tertiary centers. The Great Orchestra of Christmas Charity (WOSP) fund has donated >100 HFNC devices for non-tertiary neonatal care centers in Poland.

Patient data of 361 neonates (61% of males) treated with HFNC was acquired using a web-based electronic „WOSP HFNC Registry” from 50 units that received equipment from the charity fund. Analyzed variables included demographic and perinatal data, causes of respiratory failure, parameters and length of high flow therapy, its effectiveness and complications. All patients were treated using the same device (Vapotherm Precision Flow).

Patients’ mean gestational age was 37 weeks (standard deviation (SD) 3.3 weeks) and mean birth weight was 3047g (SD 854g). Mean Apgar scores 1’=8, 5’=9 (SD 2). 63% of patients were born by cesarean section. Most common indications for HFNC included respiratory distress syndrome, pneumonia and transient tachypnea of the newborn. Median time of HFNC initiation was 2 hours, median time of therapy 18 hours. Mean initial flow was 5.4 (SD 1.2), mean maximum flow was 5.6 (SD 1.2) and mean terminal flow was 5.0 (SD 1.4). Median initial FiO2 was 0.3, median terminal FiO2 was 0.21. 62% of neonates were weaned from HFNC, 30% were effectively stabilized using HFNC until their ambulance transfer to a higher level of care unit. Only 3 newborns who failed HFNC required intubation and mechanical ventilation, other were managed using nCPAP or NIPPV. Pneumothorax was reported in 3 cases.

Preliminary analysis of the registry data suggests that HFNC used in non-tertiary centers can be an effective and safe therapy. However, in contrast to previous studies reported population comprised mainly term and late-preterm infants. Considering relatively short median time of therapy and set flows it seems that significant proportion of patients had relatively mild course of respiratory distress.

COI: none declared
WEANING HIGH FLOW NASAL CANNULA THERAPY ON THE NEONATAL UNIT: CLINICAL PREDICTORS OF SUCCESS.

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CONTENT:

High flow nasal cannula therapy (HFNC) is widely used on the neonatal unit, but there is currently no evidence-based strategy for weaning or discontinuing support. A Cochrane review assessing strategies for discontinuation of high flow in preterm infants found no studies to include, and significant variation in practice exists. This study reviewed high flow weaning attempts in a tertiary neonatal unit, aiming to identify clinical factors predictive of successful weaning, to aid decision making and guideline development.

A retrospective analysis of high flow weaning in a tertiary neonatal unit over a one year period from 1st January to 31st December 2018 was performed. All infants without major congenital anomalies were included, and data obtained from their clinical records. Infant demographics, general respiratory management, and details of all changes in HFNC including flow rate, FiO2, CO2 levels and timing of changes were recorded.

Successful weaning was defined as remaining at a lower flow rate for >72 hours, and successful discontinuation defined as remaining off respiratory support for >72 hours.

87 infants received 135 episodes of HFNC, with 522 flow rate decrements: 410 weaning and 112 discontinuation steps. Median gestation was 28+4 (IQR 27-30) and age when starting HFNC 16d (IQR 5-39d). Median HFNC duration was 20d for infants born <28wk and 8d for those 28-32wk.

Successful weaning occurred in 326/370 (88.1%) when FiO2 ≤ 0.35 and 27/40 (67.5%) when FiO2 >0.35. Flow rate changes ranged from 0.5-2l/min, with no correlation between size of change and success. Median failure time for unsuccessful weaning attempts was 31 hours.

Discontinuation of HFNC was successful in 81/100 (81%) when FiO2 ≤ 0.35. Cessation of HFNC occurred at 1.5-5L/min, with no correlation between flow rate and success.

CO2 was measured prior to weaning in 276/522 (52.8%). Success of weaning was similar in normo- and hypercapnia (88.4% and 89.8% with pCO2 <7 or ≥7kPa respectively).

Weaning and discontinuation of high flow nasal cannula support appears more successful when FiO2 ≤0.35. Although in this cohort flow rate and CO2 did not correlate with success of weaning, this may be important in high risk subgroups such as extremely preterm infants and those with BPD. Ultimately, randomised controlled trials are required to assess optimal high flow weaning strategies.

COI: None declared
ID: 747

**TITLE:** COMPARISON OF LISA AND INSURE METHODS IN ELBW INFANTS GIVEN SUSTAINED LUNG INFLATION VIA SHORT BINASAL PRONG AT BIRTH

**AUTHORS:** Tuğba Alarcon-Martinez1, Mehmet Buyuktiryaki, Bengu Karacaglar1, Gulsum Kadioglu Simsek1, Fuat Emre Canpolat1, H. Gözde Kanmaz Kutman1

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**CONTENT:**

Application of sustained lung inflation via short binasal prong at birth has been reported to decrease the requirement of mechanical ventilation and respiratory morbidities. Herein, we compare the effects of less invasive surfactant administration and Intubate-Surfacant-Reintubate methods in terms of mechanical ventilation requirement in the first 72 hours and other respiratory outcomes in preterm newborns who were applied prophylactic sustained lung inflation via short binasal prong immediately after birth.

Medical records of preterm infants who were born at 26+0/7 to 29+6/7 weeks of gestation between 2015 and 2017 were assessed retrospectively in terms of prophylactic SLI application at birth and surfactant administration via LISA or INSURE method. Infants who were given SLI at birth and administered surfactant either with LISA or INSURE were included into study. Poractant alfa was given at 200mg/kg dose as a surfactant preference.

Analysis of the data of 43 LISA-treated and 39 INSURE-treated infants revealed the mean gestational age as 28.1±1.1 and 28.1±1.2 weeks and mean birth weight as 1046±227 and 1035±236 g in LISA and INSURE groups, respectively. Demographic characteristics of the infants in both groups were similar. The mechanical ventilation requirement in the first 72 hours of life (%20.9–%51.3, p=0.004) was lower in LISA-treated infants. Although it was no statistically significant, LISA group had lower incidence of moderate-severe BPD (%8.3–%21.9, p=0.17). As well as the shorter duration of mechanical ventilation, requirement of intubation and treatment with multiple doses of surfactant were lower in LISA-treated infants. LISA method was found as an independent factor in reducing mechanical ventilation requirement in the first 72 hours of life and at any time (Table).

Administration of surfactant via LISA method decreases mechanical ventilation and treatment with additional doses of surfactant in premature newborns who were given prophylactic sustained lung inflation at birth.

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The Rates of BPD and MV Requirements among the groups

**COI:** None declared.
ID: 750

TITLE: PREDICTORS OF NON-INVASIVE VENTILATION FAILURE IN PRETERM INFANTS ≤ 30 GESTATIONAL WEEKS

AUTHORS: Mehmet Buyuktiryaki1, Evrim Alyamac Dizdar1, Tugba Alarcon-Martinez1, Nilufer Okur1, Fatma Nur Sari1, Cuneyt Tayman1, Serife Suna Oguiz1

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CONTENT:

Non-invasive ventilation (NIV) has been demonstrated to decrease the mortality and requirement of invasive mechanic ventilation in premature infants. However, the rate of NIV failure in very low birth weight infants ranges from 25% to 50%. Herein, we aimed to identify the variables associated with NIV failure and determine the preterm morbidities in very low birth weight (VLBW) infants who failed with NIV.

Medical records of VLBW infants who were born before 30 weeks of gestation and who required non-invasive ventilation (nCPAP, NIPPV, BIPAP) in the first hours of life were assessed retrospectively. Respiratory support is augmented to NIPPV or BIPAP when preterm infants fail under nCPAP support. Failure of NIV was defined as either hypoxemia (PaO2 < 50 mmHg and FiO2 > 50), respiratory acidosis (pH < 7.20 and PaCO2 > 60 mmHg) or recurrent apnea. Preterm infants who failed in the first 72 hours of life were compared with stable infants. Predictors of NIV failure were determined with multivariant regression analysis. Infants who required intubation in the first hours of life, infants with perinatal asphyxia and major congenital anomaly were excluded from the study.

Of 443 infants eligible for analysis, 101 (22.8%) preterm infants failed under NIV support. Gestational age, birth weight and antenatal steroid exposure were significantly lower in preterm infants who failed. The incidence of severe IVH, moderate-severe BPD and severe ROP were higher in infants with NIV failure (Table). The first respiratory support was determined as CPAP (75.2%) and NIPPV or BiPAP (24.8%) in preterms who failed NIV. According to the multi-variate logistic regression analysis, antenatal steroid treatment decreased the risk of NIV failure (OR: 0.53, 95% CI: 0.29-0.94; p=0.03). However, using nCPAP as primary respiratory support (OR:2.61, 95%CI:1.53-4.48; p<0.001), surfactant requirement (OR:2.40, 95%CI:1.36-4.25; p=0.003) and 2 or more doses of surfactant administration (OR:3.57, 95%CI:1.89-6.74; p<0.001) were associated with significantly higher likelihood of NIV failure.

Antenatal steroids and primary NIPPV support might be advantageous for a successful NIV.

IMAGES:
https://www.eiseverywhere.com/eselectv3/v3/events/351149/submission/files/download?fileID=65003722f9c6b2bd24a8b408f73425-MjaXw0wNSM1Y2UyNjY2Y2RINmNh

Demographic and clinical characteristics of study groups

COI: None declared.
ID: 865
TITLE: COMPARISON OF BUBBLE CPAP SYSTEMS INTENDED FOR NEONATAL USE IN LOW-INCOME COUNTRIES: CONSEQUENCES ON PERFORMANCE WHEN DEVIATING FROM THE ORIGINAL DESIGN
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CONTENT:

Low cost, high quality and robustness makes bubble CPAP ideal for use in low income countries. The original bubble CPAP consists of a low resistance interface directly connected to wide bore expiratory tubing. Several modifications of this design, aimed for use in low-income countries, are available. We have identified three design alterations of potential clinical importance based on published manuscripts and online material. The aim of our study was to review design alterations to the original bubble CPAP system and confirm effects on performance related to interface resistance and the diameter of the expiratory tubing.

Effects of design alterations to the original bubble CPAP were investigated in a mechanical test lung (Ingmar Medical, Pittsburgh, USA). All measurements were performed with non-humidified air, without leakage and at room temperature. The commercially available Fisher&Paykel was added as an example of a system with the original design properties. With simulated infant breathing (32 mL, 60 RR) the expiratory tubing (1.5 m and 3-12 mm inner diameter) was tested with Hudson and Fisher&Paykel prongs and RAM cannula at a CPAP of 5 cm H2O and a fresh gas flow of 6 and 8 L/min. The main outcome was delivered CPAP (end expiratory pressure) and resistance to breathing recorded in 17 consecutive breaths.

The three design alterations identified were; high resistance interface, increased dead space and high resistance of expiratory tubing. 1) A high resistance interface displayed increased resistance to breathing (measured as imposed work of breathing). The delivered mean CPAP level comparable to interfaces with lower resistance. 2) Increased dead space would, in a setting without leakage, not be safe and was not further tested. 3) With increasing expiratory tubing resistance, the delivered CPAP was higher than the submersion depth indicated. The increase in delivered pressure was higher with higher fresh gas flows. Using expiratory tubing with a smaller internal diameter or interfaces with higher resistances such as the RAM cannula increased the resistance to breathing. Using a low resistance interface and expiratory tubing with an inner diameter greater than 8 mm eliminate the problem.

Unintentional use of high CPAP or resistance to breathing could potentially increase the risk of air leak, gastric distention and respiratory failure. Usage of novel designs in low-income countries are of particular concern since failure on CPAP or complications may be fatal. A hypothesis is that leakage to some extent prevent negative effects. Users have to be aware that modifying the original bubble CPAP alters performance and possibly safety.

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Figure 1: Summary of deviations from the original bubble CPAP system of clinical concern. Effects of increased interface resistance and increased resistance of expiratory tubing was confirmed in a mechanical lung model. Increased dead space...
was not considered safe and not further tested. If no interface or mouth leakage is present it will lead to complete rebreathing.

**COI:** None declared.
The results have partly been presented at PAS 2019, Baltimore
ID: 880

**TITLE:** DOES NASAL CPAP DECREASE NEONATAL MORTALITY OF PRETERM INFANTS WITH RDS IN DEVELOPING COUNTRIES?

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**CONTENT:**

Respiratory Distress Syndrome (RDS) is a leading cause of preterm infant death in developing countries. Nasal Continuous Positive Airway Pressure (CPAP) is recommended by the World Health Organization for preterm RDS. High quality evidence confirms the efficiency of CPAP to treat RDS in high-income countries and low quality evidence suggests it is safe and efficient for preterm RDS in low- and middle-income countries (LMIC), but there is a lack of evidence that CPAP reduces the mortality of preterm newborns in low-resource countries. We report the impact of CPAP on preterm survival after the introduction of nasal CPAP in the two main neonatal unit of Benin, Sub-Saharan Africa.

We report the results of 1) a safety and feasibility study of CPAP for the treatment of preterm RDS in the main neonatal unit of Benin (2013), and 2) a descriptive longitudinal cohort study after the introduction of CPAP in the two main neonatal units of the country, coupled with a multifaceted educational program targeting the main causes of morbidity in the preterm infant (2015-2019). Survival numbers and percent are reported by birthweight categories (1000-1499 grams, 1500-1999 grams, 2000-2499 grams). We describe the effect of co-interventions (hand-hygiene, enhanced nutrition, Kangaroo-mother care and phototherapy) on preterm survival and the main reasons behind failure of survival despite nasal CPAP.

Baseline preterm RDS mortality was 36%. Our safety and feasibility study showed that CPAP was culturally acceptable and efficient to decrease the first day mortality of preterm RDS, but that most infants would then succumb due to malnutrition and infections within 1-2 weeks of age – hence mortality of preterm infants treated with CPAP for RDS decreased only to 32%. Survival was poor for preterm with birthweight below 1500 grams. Our longitudinal cohort study showed that preterm RDS survival increased significantly after our multifaceted intervention, with mortality from preterm RDS being as low as 22%, and that survival increased significantly in the BW category of 1000-1499 grams. Best results were observed when Kangaroo Mother Care (KMC) was applied, with mortality at/below 3%. Lack of human resources and lack of universal coverage are serious elements limiting preterm survival.

CPAP alone has limited effect on the survival of preterm infants with RDS in low-resource countries such as Benin, but the association of CPAP with co-interventions to improve hand hygiene and nutrition, with emphasis on KMC, have proven to decrease sustainably the mortality of preterm infants with RDS in the 2 main neonatal units of Benin. These interventions have the potential to decrease preterm mortality in other low-resource countries.

**COI:** None declared