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#### 414. Issues in neonatal and paediatric intensive care

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**P4125****Educating fellows in CanMEDS physician roles via a quality improvement-based curriculum**William Carey, Christopher Colby, *Division of Neonatal Medicine, Mayo Clinic, Rochester, MN, United States*

**Background:** Of the many CanMEDS physician roles that have been adopted by European medical educators, evidence suggests that several may be particularly challenging to teach and assess, namely: Health Advocate, Collaborator, Scholar and Manager.

**Objective:** Since Quality Improvement (QI) activities have been shown to provide medical residents a means by which to learn skills relevant to the above CanMEDS roles, we sought to determine whether a QI-based curriculum would afford our fellows a robust, level-appropriate and assessable learning experience.

**Methods:** Our fellows participated in our division-level program of continuous quality improvement. In doing so, they learned and applied QI principles as they developed an evidence-based respiratory treatment protocol (RTP) intended to reduce the incidence of chronic lung disease (CLD) among neonates born at <29 weeks gestation. To assess fellow competence in CanMEDS roles, the fellowship program directors maintained educational portfolios for each fellow, including self-reflections, competency-based evaluations and evidence of scholarship.

**Results:** Our fellows successfully implemented their RTP, then collected, analyzed

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and reported outcomes data to division leadership. Our fellows' RTP reduced the incidence of CLD nearly 50% within one year, results they have presented at regional and national academic meetings. Last, this QI effort enabled one of our fellows to earn credit toward her maintenance of certification by the American Board of Pediatrics.

**Conclusion:** A QI-based curriculum may be an effective means by which to teach and assess critical care fellows in the more challenging CanMEDS physician roles while also improving respiratory outcomes.

#### P4126

##### The association of NQO1 C<sup>609</sup>T polymorphism and the susceptibility of bronchopulmonary dysplasia in preterm neonates

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**Introduction:** The development of bronchopulmonary dysplasia (BPD) involves genetic and environmental factors. Supplemental oxygen can damage the pulmonary epithelium through the generation of reactive oxygen species (ROS). The NAD(P)H:quinone oxidoreductase (NQO1) enzyme is involved in ROS detoxification. The encoding gene is subjected to the inactivating sense polymorphism (C<sup>609</sup>T). Individuals homozygous for the mutant allele (T/T) completely lack NQO1 activity, whereas heterozygotes (C/T) have low enzyme activity. We conducted a case-control study to investigate the potential role of NQO1 inborn polymorphism in BPD susceptibility.

**Patients/Methods:** The study enrolled 119 Greek premature neonates with gestational age  $\leq 32$  weeks; 42 developed BPD (case group) and 77 did not develop BPD (control group). Genomic DNA was extracted from peripheral blood of all neonates. NQO1 genotyping was performed by real-time PCR. The NQO1 gene status was also evaluated in respect to gender.

**Results:** A different distribution of NQO1 genotypes was found between BPD neonates and controls, with a higher frequency of variant genotypes (heterozygotes C/T and homozygotes T/T) in BPD population (50% in BPD vs 28.6% in no BPD neonates,  $p=0.046$ ). Thus, a significantly higher frequency of the mutant T allele was observed in BPD neonates as compared to controls (0.27 vs 0.17,  $p=0.058$ ). According to gender, we observed no genotypic differences.

**Conclusion:** The higher incidence of the C/T and T/T variant genotypes among neonates who developed BPD suggests that the NQO1 C<sup>609</sup>T inborn polymorphism probably constitutes an early biomarker of BPD development.

#### P4127

##### Functional respiratory status in preterm children with and without bronchopulmonary dysplasia

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Differences of Tidal Breath (TB) parameters in preterm infants with and without Bronchopulmonary Dysplasia (BPD) may be connected not only with consequences of Mechanical Lung Ventilation (MLV), but with a structural immaturity of the respiratory system of preterm infants.

**Aim:** To identify differences of TB-parameters in preterm infants with and without Bronchopulmonary Dysplasia up to 2 years old.

**Material and methods:** TB measurements in 33 preterm infants without BPD (1) and 11 ones with BPD (2) with corrected age 1-3 months were performed (MasterScreen, Jaeger, Germany). The median gestational age in group 1 was 32 weeks (29-35w), height was 56.7cm (49-63.7cm) and weight – 5.0kg (3.0-7.0kg), and in group 2 – 29 weeks (27-32w), 54.5cm (47-63cm) and 4.8kg (2.9-6.8kg). 10–20 breathing cycles were evaluated. Six TB parameters were analyzed, but only two were significant: time of reach Peak Tidal Expiratory Flow as a proportion of total Expiratory time (tPTEF%tE) and expiratory Volume till Peak Tidal Expiratory Flow as a proportion of total expiratory Volume (VePTEF%Ve).

**Results:** Significant differences between infants with and without BPD were not found in anthropometric parameters with U-test ( $p<0.05$ ). On comparison of TB-parameters between both patient's groups according to the p-value of the ANOVA we found significantly decreased tPTEF%tE and VePTEF%Ve in group 1 as well as in group 2 ( $p=0.04$  and  $p=0.03$ ). In infants with BPD the mean tPTEF%tE was 19.0% (12.0-33.3) and mean VePTEF%Ve was 22.5% (17.8-32.2) in comparison to tPTEF%tE 25.6% (16.8-36.9) and VePTEF%Ve 27.3% (19.7-36.7) in infants without BPD.

#### P4128

##### Prolonged apnea, desaturations and bradycardia in infants with bronchopulmonary dysplasia

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**Objective:** Apnea is a common breathing pattern in premature infants espe-

cially those with bronchopulmonary dysplasia (BPD). Our aim was to describe occurrence of apnea, desaturations and bradycardia in infants with BPD.

**Methods:** We performed respiratory study in 25 premature infants with BPD and 25 non-BPD prematures (gestational age 26-30 weeks). Infants were examined 1–3 times at ages of less than 29 days, 29-50 days, more than 50 days. Proportion of apnea of  $\geq 20$  s duration or events accompanied by oxygen saturation (SatO<sub>2</sub>) falls  $\leq 80\%$ , bradycardia  $\leq 80$  beats per minute in all apnea of  $\geq 10$  s duration was analyzed.

**Results:** During the first 28 days infants with mild BPD had less prolonged apnea than non-BPD infants (49% vs. 59%,  $P=0.08$ ) and more events with SatO<sub>2</sub>  $\leq 80\%$  (43% vs. 27%,  $P<0.05$ ). During the 2nd age interval there was no difference between these groups. Infants with moderate to severe BPD had more apnea with SatO<sub>2</sub>  $\leq 80\%$  compared to infants with mild BPD and without BPD at the 2nd (59%, 41% and 41%, resp.) and 3rd (50%, 18%, 0) age intervals. Bradycardia  $\leq 80$  beats per minute accompanied more apnea in infants with BPD, mostly in mild disease (9% in the 1st, 11% in the 2<sup>d</sup>, 15% in the 3rd age interval), than in patients without BPD (7%, 1%, 0, resp.). Main neurologic abnormalities appeared not to differ among groups.

**Conclusion:** Infants with moderate to severe BPD are characterized by deep SatO<sub>2</sub> falls during apnea until the age of more than 50 days. Infants with mild illness have similar proportion of prolonged apnea and apnea with SatO<sub>2</sub>  $\leq 80\%$  as prematures without BPD, when elder than 28 days. Apnea in BPD infants are often accompanied by significant bradycardia.

#### P4129

##### Development of a quality of life instrument for children with bronchopulmonary dysplasia

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**Background:** Bronchopulmonary dysplasia (BPD) is a common complication of preterm birth. It is associated with prolonged hospitalization, long-term pulmonary morbidity and an increased risk for adverse neurodevelopmental outcome. The impact of these complications on health-related quality of life (HRQL) is not known because there is no disease-specific instrument to measure HRQL available.

**Aim:** To develop a disease-specific questionnaire to measure HRQL in children with BPD aged 4 to 8 years old.

**Methods:** Participants: children aged 4 to 8 years old with BPD. The first steps in the development of a HRQL instrument are item generation and item reduction. Sources for item generation were literature, expert opinion and parents of participants. For item reduction, parents indicated how much the items affected the HRQL of their child. The clinical impact method and item analysis were used to reduce items.

**Results:** 51 children participated in the study; 20 in item generation and 31 in item reduction. 130 items were identified. With the clinical impact method 53 items with an overall importance (OI)  $>1.00$  were selected. Three items with highest OI were 'easily distracted' (2.52), 'having a cold for longer period of time' (2.42) and 'coughing' (2.39). After item analysis, 47 items remained in the questionnaire. Items were linked to a variety of subjects such as pulmonary problems, growth/nutrition, exercise, school, behavior, social and emotional functioning.

**Conclusion:** This is the first time the development of a disease-specific instrument to measure HRQL in BPD has been undertaken. The items in the developed questionnaire have clinical impact. The next step will be to determine validity of these items.

#### P4130

##### Impact of electronic data monitoring on the incidence of hyperoxia in premature neonates

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**Background:** Episodes of hyperoxia, a known risk factor for bronchopulmonary dysplasia in premature neonates, most often are identified manually by care providers.

**Objective:** We sought to determine whether an automated electronic data surveillance tool (DST) would reduce the rate of hyperoxic episodes in premature neonates.

**Methods:** We studied all neonates born at  $<29$  weeks gestation who were admitted to our NICU between August 2008 - June 2010. Because a standardized respiratory treatment protocol (RTP) for this same population had been introduced in early 2009, the study period was divided into three epochs (E) of equal duration as follows: E1 - no RTP, no DS; E2 - with RTP, no DS; E3 - with RTP, with DS.

Because our standard clinical data systems collect data at 15 minute intervals, we

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prospectively defined a hyperoxic episode as three consecutive measurements (at 0, 15 and 30 minutes) of  $O_2$  sat  $>92\%$ , the upper limit of the RTP.

During E1 and E2,  $O_2$  sats  $>92\%$  were detected manually by the bedside nurses. During E3, the DST analyzed clinical data and automatically notified the charge nurse of a patient's hyperoxic episode.

We retrospectively compared the rate of hyperoxic episodes of each epoch, using the Chi-squared test to determine statistical significance.

**Results:** Neonates treated during E3 experienced fewer hyperoxic episodes than those treated during E2 (17 v. 24 episodes per 1000  $O_2$  sat measurements;  $p < 0.0001$ ). These rates both were lower than that of E1 (41 episodes per 1000  $O_2$  sat measurements;  $p < 0.0001$ ).

**Conclusion:** Use of a DST was associated with less frequent episodes of hyperoxia among premature neonates and seemed to enhance the efficacy of a respiratory treatment protocol.

#### P4131

##### G-CSF administration improves chronic lung disease caused by exposure to high-concentration oxygen in neonatal mice

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**Background:** Chronic lung disease (CLD) is a condition that results from the inflammation-induced destruction and developmental arrest of the lungs of premature infants. To date, there is no effective treatment for CLD. Hematopoietic stem cells have been reported to differentiate into pulmonary type II epithelial cells. It is known that G-CSF acts on hematopoietic stem cells to mobilize them in the peripheral blood. It has also been reported that G-CSF exerts anti-inflammatory effects. In this study, we investigated whether G-CSF administration could improve a mouse model of CLD caused by exposure to high-concentration oxygen.

**Methods:** Neonatal mice within 24 hours after birth were placed in 80% oxygen or room air for 21 days. From day 23, pups were administered 0.5 micro gram/g of G-CSF or saline for 5 days. The lungs were removed in postnatal week 6, and lung sections were stained with HE and Masson's trichrome and immunostained for PCNA and  $\alpha$ -SMA for histology.

**Results:** Compared with the control groups, the oxygen-exposed groups showed a significant emphysematous change. The oxygen-exposed, G-CSF administered group showed a significantly improvement in pulmonary emphysema than the oxygen-exposed, saline administered group. There were no significant differences in staining with Masson's trichrome nor immunostaining for PCNA and  $\alpha$ -SMA.

**Discussion:** G-CSF administration significantly improved a mouse model of CLD. It is unclear whether G-CSF-mobilized peripheral blood stem cells differentiated into pulmonary epithelial cells, whether G-CSF induced the proliferation and differentiation of type II epithelial cells, or whether G-CSF exerted anti-inflammatory effects.

#### P4132

##### Gestation at delivery and outcome in CDH infants following fetoscopic tracheal occlusion

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Newborns with congenital diaphragmatic hernia (CDH) suffer substantial morbidity and mortality. In non-randomised studies, fetal endoscopic tracheal occlusion (FETO) has improved survival, but is associated with an increased risk of premature delivery.

**Aims:** To determine the mortality and morbidity of CDH infants who had undergone FETO and if this was adversely influenced by delivery prior to 35 weeks gestational age (GA).

**Methods:** The outcome of all CDH infants born at King's College Hospital who had undergone FETO during 2004 to 2009 were reviewed. Their lung to head ratios (LHR) pre and post FETO were recorded. Short-term outcomes included the duration of mechanical ventilation, use of high frequency oscillation (HFO) or inhaled nitric oxide therapy (iNO). Long term outcomes included: respiratory gastrointestinal, neurological, surgical and musculoskeletal problems.

**Results:** Sixty one infants were born during the study period. The 33 infants who were born  $< 35$  weeks GA had a lower LHR prior to delivery ( $p < 0.001$ ) and a lower change in LHR post FETO and prior to delivery ( $p < 0.001$ ); they also had a longer duration of ventilation ( $p < 0.001$ ). Amongst the infants born  $< 35$  weeks GA survival to discharge was lower (18% versus 82%,  $p < 0.001$ ) and a greater proportion required surgery for gastro-oesophageal reflux (50% versus 9%,  $p = 0.011$ ).

**Conclusion:** CDH infants who have undergone FETO have greater mortality and morbidity if born  $< 35$  weeks GA, emphasising the need to reduce premature delivery following FETO.

#### P4133

##### Delayed insertion of nasopharyngeal airway may result in failure to establish oral feeding and prolonged hospitalization in infants with Pierre Robin sequence

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**Introduction:** Nasopharyngeal airway support (NPA) is established as a safe, effective method of alleviating upper airway obstruction in infants born with the Pierre Robin Sequence (PRS). It is the preferred intervention for infants referred to our institution for respiratory assessment.

**Aim:** To determine if timing of 1st NPA insertion affects duration of hospitalization for infants with PRS referred to RHSCE.

**Methods:** A retrospective case note review of the management of infants referred to RHSCE with PRS from Oct 2009-Oct 2011 was performed.

**Results:** 12 infants were included in this study. 7/12 infants were successfully discharged with NPA support. In 5/7 infants 1st NPA was inserted within 48hrs of admission and discharge occurred at a median of 15 days. In the other 2 infants, NPA was not inserted until day 6 & 10 of admission respectively. Only these 2 infants required nasogastric feeding on discharge. Parental training commenced on average 5 days later and these infants required up to a week longer in hospital. These delays did not however, impact on the timing of eventual cleft surgery.

3/12 infants were preterm and could not be managed initially with NPA due to small size. These infants all required a period of non-invasive ventilation and also had a longer hospital stay.

**Conclusions:** Our results suggest that delayed insertion of NPA in infants with PRS may result in later establishment of oral feeding and prolonged hospitalization. NPA insertion within 48hrs of admission is suggested as optimum. Preterm infants are also identified as requiring a longer hospital stay with an alternative approach to airway management.

#### P4134

##### Respiratory dead space but not neonatal lung disease is associated with lung clearance index in preterm neonates

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**Background:** Neonatal lung disease (NLD), gestational age *per se* (GA) and breathing pattern may influence gas mixing efficiency in neonates.

**Aims:** To assess the effect of NLD, GA and breathing pattern on the lung clearance index (LCI) in preterm and term neonates.

**Methods:** 236 preterm (GA 23-36 w) and 232 term healthy control infants from two centres (Berne and Perth) were studied at a mean (standard deviation) postmenstrual age of 43.4 w (3.5) in quiet unsedated sleep using multiple breath washout (MBW) with 4% sulphur hexafluoride and a mainstream ultrasonic flowmeter (Spiroson Exhalyzer D, Ecomedics AG, Duernten, CH). Functional residual capacity (FRC) and LCI were calculated from the washout trace. Tidal volume ( $V_T$ ), respiratory rate (RR) and respiratory dead space ( $V_D$ ) estimated from the molar mass signal were calculated during 30 s of tidal breathing prior to MBW. We used multivariable linear regression to analyse outcomes.

**Results:** Only RR ( $R^2=0.04$ ,  $p < 0.001$ ) and  $V_D/V_T$  ( $R^2=0.16$ ,  $p < 0.001$ ) were positively associated with LCI. No other factors including presence of bronchopulmonary dysplasia, days of supplemental oxygen, GA, body size and body proportions at birth and at test were significantly related to LCI. After adjusting for  $V_D/V_T$ , RR was no longer significantly associated with LCI.

**Conclusions:**  $V_D/V_T$  is associated with LCI in preterm neonates and should be considered as a relevant factor when assessing and interpreting LCI in infants. The effect size of this association is moderate.

#### P4135

##### Effect of the level of volume-targeted ventilation on the spontaneous respiratory activity of infants born at term

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Prematurely born infants frequently breathe while being mechanically ventilated. The pattern of their respiratory efforts with ventilator inflation influences outcome, in particular active expiration leading to pneumothorax.

**Aim:** To compare patient-ventilator interactions in infants born at term at different levels of volume-targeting (VT).

**Methods:** 15 infants, median gestational age 38 (range 34-41) weeks were studied at a median postnatal age of five days. The infants were studied at VT levels of 0, 4 and 6 ml/kg, applied in random order. Five infants were on conventional ventilation (CMV) and 10 on triggered ventilation (PTV). Oesophageal, gastric and airway pressures, flow and volume were simultaneously recorded for at least five minutes at each VT level; 50 consecutive breaths were analysed at each VT level.

**Results:** In the infants studied on CMV, active expiration was more common at

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a VT level of 4 ml/kg than at VT levels of 0 and 6 ml/kg ( $p < 0.0001$ ), whereas in infants on PTV, active expiration was significantly lower at 4 ml/kg than at VT levels of 0 and 6 ml/kg ( $p < 0.0001$ ) (Table). At each VT level, the occurrence of active expiration differed significantly between ventilator modes.

	CMV	PTV	p
No VT	48	56	<0.0001
VT 4 ml/kg	77	37	<0.0001
VT 6 ml/kg	42	48	0.003

Data are presented as % of inflations associated with active expiration.

**Conclusion:** The underlying mode of ventilation significantly influences whether low compared to higher levels of volume targeting will increase active expiration.

#### P4136

##### Optimal PEEP in the first week of life in mechanically ventilated extremely preterm newborn infants: Clinical setting vs. optimal setting as registered by forced oscillation technique (FOT)

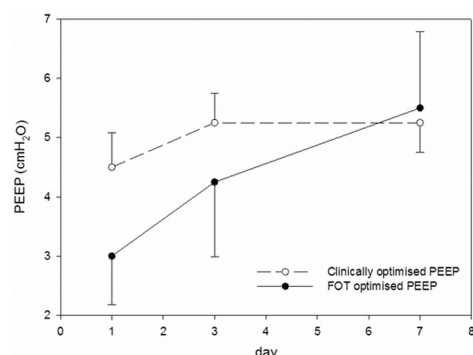
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Recently it has been shown that the use of forced oscillation technique (FOT) allows identifying an optimal open-lung PEEP minimizing mechanical stress to the lungs (Kostic P, Crit Care. 2011).

The aim of this study is to characterize the optimal mechanical PEEP settings in the first week of life in mechanically ventilated preterm newborns and to compare it to the PEEP set by current clinical approach.

Four preterm newborns (GA=23-27wks, BW=467-964g) were studied at the first, third and seventh day of life. PEEP was increased by 2cmH<sub>2</sub>O above the clinically set PEEP and then decreased by four 5-minute steps of 1cmH<sub>2</sub>O. For each step total respiratory input reactance (Xrs) at 10Hz was measured at end-expiration by sinusoidal FOT overimposed on ventilation waveform. The optimal mechanical PEEP was defined as the PEEP at which the maximum of Xrs was reached (Dellacà, Int Care Med, 2011).

Mean±SD values of the clinically set PEEPs and the mechanically optimal PEEPs are shown in the figure.



The higher inter-subject and day-by-day variability of the mechanically optimal PEEP suggests that FOT could help in fine tuning PEEP settings related to the lung mechanical changes over time in each patient. Future studies will be address whether setting the mechanically optimal PEEP could be beneficial from a clinical point of view.

#### P4137

##### Computerized quantification of wheezing in neonates: Relationship with conventional lung function parameters

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**Objective:** Computerized respiratory sound analysis has been used to evaluate wheeze in infants, but it is not known whether the acoustic detection of wheeze is associated with impaired lung function. The present study aimed to investigate the relationship between wheeze detection and conventional parameters of lung function testing (LFT).

**Methods:** Computerized lung sound analysis with quantification of wheezing (PulmoTrack®) was performed in 78 neonates at a median (IQR) postmenstrual age of 48 (44-59) weeks and a body weight of 4818 (3835-6140) g. In the same session, LFT was performed which included bodyplethysmography, tidal breathing measurements, SF6 multiple breath washout, measurement of respiratory mechanics by the occlusion test, forced expiratory flow (V' maxFRC) by rapid thoracoabdominal compression and capillary blood gas analysis.

**Results:** Wheezing >5% of the breathing cycle was detected in 41/78 (53%) infants, 18/78 (23%) had inspiratory and 29/78 (37%) expiratory wheezing. Infants

with and without wheezing did not significantly differ in postmenstrual age and body weight. Inspiratory wheezing had no relationship with LFT parameters. In contrast, infants with expiratory wheezing had significant changes in their breathing pattern and respiratory mechanics with increased tPTEF/TE ( $p=0.034$ ), end-expiratory flow (TEF10,  $p=0.027$ ), airway resistance ( $p=0.005$ ) and respiratory resistance ( $p=0.036$ ).

**Conclusion:** Computerized wheeze detection is easy to perform in unsedated infants during natural sleep and may help to identify infants at risk of obstructive airway disease.

#### P4138

##### HRVC is the commonest rhinovirus group detected in children admitted to a paediatric intensive care unit with respiratory illnesses

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**Introduction:** Respiratory viruses account for a significant proportion of acute admissions to the paediatric intensive care unit (PICU). Acute respiratory illnesses (ARI) represent 10-15% of all admissions to PICU. Recent studies have shown that human rhinovirus (HRV) was the most frequent virus detected in severe cases of ARI admitted to a PICU. There has been no study to date examining the prevalence of HRV groups (including the newly discovered HRVC group) in children admitted to a PICU.

**Aim:** The aim of this study was to determine the prevalence of different HRV groups in children with respiratory illnesses admitted to a tertiary PICU.

**Methods:** Nasopharyngeal aspirates (NPA) and clinical information were obtained from children admitted with respiratory illnesses to PICU between March 2009 and July 2011. RNA was extracted from NPA, and reversed transcribed. From cDNA, a 2-step PCR of the HRV 5'NCR was used for HRV detection, and sequencing for typing.

**Results:** NPA from 229 children admitted to PICU were analysed. HRV was the commonest virus, being present in 93 (40.6%) samples examined, followed by respiratory syncytial virus (RSV) which was identified in 50 (21.8%) samples. Of the 77 NPA available for HRV typing, HRVC was found to be the commonest HRV group detected, representing 42 (54.5%) of the samples identified. HRVA group was found in 32 (41.5%) and HRVB in 3 (4%) of the samples analysed.

**Conclusions:** This study demonstrated that HRV is the commonest virus identified in children admitted to a tertiary PICU with a respiratory illness. In addition, HRVC was the commonest HRV group detected across all respiratory illnesses.

#### P4139

##### Use of high flow nasal oxygen (HFNO) for bronchiolitis in a general paediatric ward: Preliminary experiences

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**Background:** Viral bronchiolitis is a leading cause of hospitalisation. Interventions to reduce morbidity are challenging. We evaluated HFNO in infants with acute bronchiolitis on a general paediatric ward. Previous HFNO experience has been in a PICU or HDU settings.

**Aim:** To assess responses to HFNO in previously well children and in those with underlying co morbidities.

**Methods:** Prospective study between November 2011 and February 2012. Inclusion criteria were patients needing >30% FiO<sub>2</sub> or a RR(respiratory rate)≥60/minute.

**Results:** Nine previously well infants, mean age 40 days (range 10-120 days) were commenced on HFNO. Mean RR and pulse rate prior to initiating HFNO was 73 and 146 respectively. Mean oxygen requirement was 37%. 5 patients had observations done before 2 hours and then between 2-4 hours. A reduction in mean RR to 54 at 2 hours and 47 at 4 hours was observed. The mean pulse rate reduced to 132 and 102. Mean oxygen requirement was higher at 2 hours (43%) but reduced at 4 hours (32%). No significant change in blood gases noted. 8 children responded well to HFNO. One patient required nasal CPAP.

Five children with underlying co morbidities and acute bronchiolitis were started on HFNO. These children were older, mean age 270 days (range 60-630). Of these 5, 3 deteriorated on HFNO and required escalating interventions.

**Conclusion:** In previously well infants with bronchiolitis, HFNO is safe in a general paediatric ward setting and offers clinical benefits within 2-4 hours. Children with underlying disorders may not respond as well and if no improvement is seen within 4 hours, stepping up treatment may be desirable.



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## P4140

**The evaluation of lung function measured by impulse oscillometry method in very low birth weight born children at preschool age**

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**Introduction:** Chronic lung disease is one of the most important complications of prematurity and results in short and long-term morbidity. Survival of more prematurely born babies leads to an increase in the incidence of bronchopulmonary dysplasia (BPD).

**Aim:** To evaluate the lung function of babies who were born under birth weight of 1500 grams using impulse oscillometry in preschool age.

**Methods:** Eighty-six children who were 3-6 years old and followed in our neonatology clinic (born under birth weight of 1500 grams) were enrolled in the study as the patient group and 40 term-born healthy children as the control group. The demographic data of the patients, duration of mechanical ventilation and oxygen therapy and presence of BPD were recorded. After routine physical examination, lung functions of children were measured by impulse oscillometry. The data were evaluated by SPSS 16 program.

**Results:** Forty-nine (57%) of 86 patients were non-BPD, 20 were mild BPD, 14 were moderate BPD and 3 were severe BPD. Weight and height of premature and control groups were similar. There was a statistically significant difference between the two groups in terms of resistance (R5,R10,R20), reactance (X5,X10,X20) and resonant frequency (fres). The airway resistance was significantly higher and reactance was significantly lower in the premature group. However, there was no difference between BPD and non-BPD groups.

**Conclusion:** Although premature babies can catch-up their peers at 3-4 years old in terms of their body percentiles, their lungs still reflect the traces of prematurity.

## P4141

**Effects of salbutamol therapy on pulmonary mechanics and chronic lung disease in very low birth weight infants**

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**Background:** To determine the changes in pulmonary mechanics before and during salbutamol therapy and to evaluate the effect of salbutamol on the duration of mechanical ventilation in very low birth weight (VLBW) ventilator-dependent infants.

**Methods:** A prospective single-centre trial was conducted. Forty-three patients (birth weight 600 to 1500 g, gestational age 24 to 32 weeks) who failed to be weaned from the respirator at 7 to 14 days of age were enrolled; 23 infants received a 7-day course of salbutamol (2.5 mg 4 times per day via nebulizer) and 20 patients were in the control group. A similar mean airway pressure (MAP) and fractional inspired oxygen concentration (FiO<sub>2</sub>), respiratory system mechanics (tidal volume (VT), respiratory compliance (Cr<sub>s</sub>) and respiratory resistance (R<sub>rs</sub>)) were measured before and on days 2, 5, and 7 of the study.

**Results:** There was a significant increase in Cr<sub>s</sub> and VT in the salbutamol group as compared with the control group (P<0.001). No major changes in R<sub>rs</sub> were observed. Salbutamol therapy significantly decreased FiO<sub>2</sub> and MAP (P<0.001) and facilitated successful weaning from mechanical ventilation. In addition to a shorter duration of mechanical ventilation (P<0.01), the occurrence of CLD (FiO<sub>2</sub> > 0.21 at 36 weeks of corrected gestational age, chest radiograph changes) was significantly decreased in the salbutamol group (P<0.01).

**Conclusions:** Our study indicate that salbutamol therapy in VLBW infants significantly improves lung's mechanics and facilitates extubation in infants and reduces the duration of mechanical ventilation and decreases CLD (at 28 days and 36 weeks) in a population of VLBW infants.

## P4142

**In vitro assessment of elastance unloading and work of breathing during proportional assist ventilation**

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Proportional assist ventilation (PAV) is a patient-triggered mode in which the elastic and resistive work of breathing (WOB) can be unloaded. The unloading level is set with the aim of achieving an optimal balance of the WOB between the ventilator and the patient. In vitro studies, however, have shown that during PAV, there are trigger delays and the pressure wave forms of the ventilator and lung models differ which may influence the relationship between the level of unloading and the WOB of the patient and ventilator.

**Aim:** To assess the WOB of the ventilator and a lung model with increasing amounts of elastance unloading.

**Methods:** A dynamic lung model, with a compliance of 0.4ml/cmH<sub>2</sub>O, was connected to a Stephanie ventilator in PAV mode. Elastance unloading was applied in stepwise increments and pressure, flow and tidal volume were recorded. Pressure/volume loops were constructed, from which the WOB was calculated for the ventilator and the lung model.

**Results:** The median tidal volume of breaths analysed was 3.75 (range 3.1 to 4.4) ml. As the elastance unloading was increased, the lung model showed a greater reduction in the elastic WOB than the increase of WOB of the ventilator.

		Level of elastance unloading (cm H <sub>2</sub> O/ml)				
		None	0.5	1.0	1.5	2.0
Elastic WOB (cm H <sub>2</sub> O.ml)	Lung model	27.5	25.0	16.0	12.7	7.9
	Ventilator	0	4.3	7.0	12.4	13.5

The WOB in the lung model, however, was underestimated by the distortion of the inflation pressure waveform due to the trigger delay.

**Conclusion:** Although elastance unloading during PAV enables transfer of the WOB from the patient to ventilator, the infant has no support during the trigger delay, thus the benefit is over-estimated.

## P4143

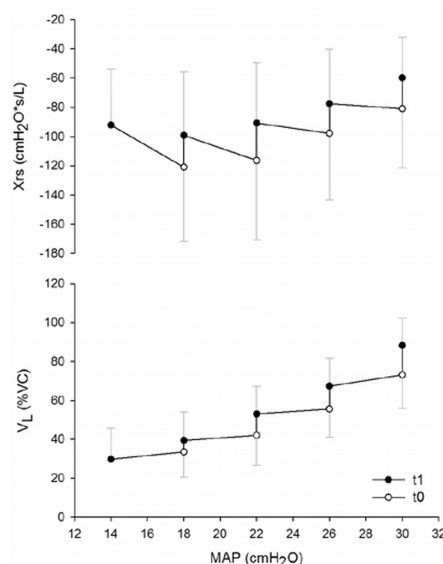
**Changes in respiratory system reactance (Xrs) during the first lung volume recruitment in preterm lambs on high frequency oscillatory ventilation (HFOV)**

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The aim of this study was to assess the dynamic changes in respiratory mechanics during the first stepwise increase of mean airway pressure (MAP) in preterm lambs receiving HFOV.

Six 132d preterm lambs were commenced on HFOV at MAP of 14 cmH<sub>2</sub>O and frequency (fosc) of 10Hz. Five min after birth MAP was increased up to 30 cmH<sub>2</sub>O in 2-min steps of 4 cmH<sub>2</sub>O. At the beginning (t0) and at the end (t1) of each step fosc was reduced to measure Xrs at 5Hz. Lung volume (VL) changes were simultaneously measured by electrical impedance tomography.

VL monotonically increased during the recruitment manoeuvre (RM). In average only the 22±2% (mean±SD) of the total change occurring at each step immediately followed the change in MAP, while the remaining 78±2% occurred over the next 2 min. Xrs at first decreased, then it increased over time stabilizing to a higher value compared with the lower MAP step.



During the first RM of an immature lung, VL recruitment is a very-time dependent phenomenon and when MAP is increased, stabilization to a higher lung volume requires few minutes and is preceded by tissue distension. These data suggest that monitoring lung mechanics during the first RM could maximise the efficacy of the procedure minimising mechanical stress to lung tissues.