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## **240. Resuscitation and ventilation in the baby and infant**

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**1916**

**Neonatal resuscitation at the community level**

Nitin Bhandari, Ram Bhandari, Poonam Kandel, Sudesh Sharma. *Child Health and Research, Integrated Rural Health Development Training Centre (IRHDTC), Kathmandu, Nepal*

**Introduction:** Community Based New Born Care Program (CB-NCP) was piloted

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in Nepal in order to reach the MDG 4 target, which focuses on decreasing the perinatal mortality. The program focuses the community level and reaches the local doctors, community level health workers and volunteers, educates and trains them with major emphasis to correctly identify and manage birth asphyxia by the use of DeLee suction and bag and mask ventilation.

**Aims:** The aim of this study was to assess the knowledge and proficiency gained by the community level (VHWMCHW, FCHV) and health facility level health workers who participated in a Community Based New Born Care training program.  
**Methods:** Based on CB-NCP curriculum designed by the Child Health Division, two sets of checklists were developed for all levels. The knowledge of the 57 health facility staffs including doctors, 36 VHWMCHW and 141 FCHV were collected through semi-structure questionnaire and the skill was assessed through the observational checklist with practical hands on bag and mask ventilation in a neonatal manikin.

**Results:** The knowledge of health workers, VHWMCHW and FCHV regarding the management of birth asphyxiated baby was 100% (N=57/57), 94% (N=34/36) and 90.8% (N=128/141) respectively. The knowledge of FCHV regarding the management of asphyxiated new born was comparatively less than Health Worker and VHWMCHW. Similarly, 49.1% (N=28/57) health workers, 50% (N=18/36) VHWMCHW and 35.5% (N=50/141) FCHV correctly demonstrated the skills of management of asphyxiated newborn.

**Conclusions:** Further studies are required to finally confirm the effectiveness of the intervention at the community level before implementing the program in other districts.

### 1917

#### The influence of oxygen inflow on ventilatory parameters during manual ventilation

Pricila Oliveira, Armando Almeida-Junior, Celize Almeida, Maria Angela Ribeiro, José Ribeiro. *Pediatrics, UNICAMP, Campinas, São Paulo, Brazil*

**Background:** Despite of self-inflating bags (SIB) widespread use, studies have confirmed that many factors may have influence on ventilation.

**Aim:** To evaluate and to compare ventilatory parameters during manual ventilation with 4 different oxygen flows attached to the SIB.

**Method:** Twenty-two physiotherapists were asked to ventilate 2 lung models (neonatal/pediatric) using 3 SIBs (Hudson<sup>®</sup>, Laerdal<sup>®</sup>, JGMoryia<sup>®</sup>) with 0, 5, 10, and 15L/min of oxygen inflow attached. A lung function monitor (CO2SMOplus<sup>®</sup>) recorded inspiratory volume (Vi), peak inspiratory pressure (PIP), peak inspiratory (PIF) and expiratory (PEF) flows, and inspiratory time (Ti). The oxygen inflows were compared using ANOVA for repeated measures and Tukey's test, with p<0.05 considered statistically significant.

**Results:** When we analyze all brands in neonatal and pediatric models, the oxygen inflows influenced Vi, PIP, PIF, and Ti (p<0.001). When compared 0 and 15L/min, we found a significant increase in PIP in all neonatal SIB brands. Also, there was a difference in Vi delivered by neonatal Hudson<sup>®</sup> SIB.

**Conclusion:** We found great variability in ventilatory parameters depending on the oxygen inflow. The Vi, PIP, PIF, and Ti showed a large variation. Professionals should be aware of those differences and the choice of the oxygen flow used should be taken with caution.

### 1918

#### Influence of mask leak on applied volumes and pressures during simulated resuscitation of neonates

Julia C. Hartung, Marcus Kelm, Hendrik Fischer, Gerd Schmalisch, Charles C. Roehr. *Neonatology, Charité Universitätsmedizin Berlin, Berlin, Germany*

**Introduction:** Self-inflating (SI) bags and T-piece resuscitators are used for bag and mask ventilation of neonates. Leaks between face and mask occur frequently. Little is known about the effects of mask leak on applied pressure and volume. We investigated these effects in an in-vitro study.

**Method:** A lung model (compliance 0.7ml/kPa) was ventilated with a mechanically operated SI-bag (Mark IV Baby Resuscitator<sup>®</sup> plus Ambu-10-PEEP valve, Ambu, Denmark) and a manually operated T-piece resuscitator (Neopuff<sup>®</sup>, Fisher&Paykel, New Zealand) (PIP=20cmH2O, PEEP=5cmH2O, Flow=8l/min, respiratory rate (RR)=40, 60, 80/min). To simulate mask leaks 4 open silicon tubes of increasing lengths [leak 1-4] were attached between the manual ventilation device and lung model. Two respiratory monitors (COSMO+, Novamatrix, USA) detected applied pressures and volumes (Vt); measurements were repeated 5 times.

**Results:** Simulated leaks at a RR of 60/min were 22% [1], 46% [2], 69% [3] and 87% [4]. With the SI-bag mean (SD) PIP fell from 20 (0.0) to 16.0 (0.0) cmH2O, PEEP from 4.8 (0.4) to 0.2 (0.4) cmH2O (p<0.001). The pressure difference (PIP-PEEP; Δp) increased and Vt increased from 9.1 (0.6) to 11.2 (0.8) cmH2O (p<0.001). Using the T-piece PIP fell from 20 (0.0) to 18.6 (0.5) cmH2O. PEEP, Δp and Vt were stable.

Increasing RR from 40 to 80/min lead to a significant decrease in leak with both devices and increase of PIP and PEEP with the bag. With the T-piece pressures were constant and Vt did not change significantly.

**Conclusion:** During bag ventilation mask leak has a significant impact on applied pressures and Vt, while the T-piece resuscitator keeps pressures and volumes constant in a wide range of leaks.

### 1919

#### Appropriate level of volume targeting for ventilated infants born at or near term

Ollie Chowdhury, Silke Lee, Simon Hannam, Gerrard F. Rafferty, Anne Greenough. *Division of Asthma, Allergy and Lung Biology, King's College London, London, United Kingdom*

**Aims:** To determine the most appropriate level of volume targeting (VT) for ventilated infants born at or near term.

**Methods:** Study one: expiratory tidal volumes (VTe) were measured during time cycled, pressure limited ventilation either using a pneumotachograph or the ventilator's software; at least 80 breaths were analysed per infant. Study two: infants were studied at VT levels of 4, 5 and 6 ml/kg delivered in random order, with return to baseline between each VT level. The transdiaphragmatic pressure-time product (PTPdi), a measure of the work of breathing, was assessed at each VT level and during the baseline periods. To measure PTPdi, oesophageal and gastric pressures are measured and PTPdi calculated by integration of the transdiaphragmatic pressure signal with time for each breath and expressed per minute. In both studies, infants are only assessed when their blood gases are within the normal range.

**Results:** To date: Study one: 20 infants, median gestational age of 39 (range 35-41) weeks, had a median VTe of 5 (range 1.4-9.7) ml/kg; 50% of infants had a VTe outside the "normal" tidal volume range (4 to 6ml/kg). Study two: the median PTPdi of 11 infants, median gestational age 39 (35-41) weeks, at a VT level of 4 ml/kg (310, IQR 244-332 cmH2O.s/min) was almost double that at 6 ml/kg (median 163, IQR 122-220 cmH2O.s/min), (p<0.001).

**Conclusion:** During time cycled, pressure limited ventilation, infants born at or near term are frequently ventilated using volumes outside the "normal" tidal range. Yet, even within that range, low compared to high levels of volume targeting significantly increase the work of breathing.

### 1920

#### Therapeutic hypercapnia prevents pulmonary hypertension in rats with bleomycin-induced chronic neonatal lung injury

Charlotte Sewing<sup>1</sup>, Julijana Ivanovska<sup>1</sup>, Crystal Kantores<sup>1</sup>, Azhar Masood<sup>2</sup>, Patrick J. McNamara<sup>2,3</sup>, A. Keith Tanswell<sup>2,3</sup>, Robert P. Jankov<sup>1,3</sup>. <sup>1</sup>Clinical Integrative Biology, Sunnybrook Research Institute, Toronto, Canada; <sup>2</sup>Physiology & Experimental Medicine, Hospital for Sick Children Research Institute, Toronto, Canada; <sup>3</sup>Department of Physiology, University of Toronto, Toronto, Canada

Bleomycin (BLEO)-induced chronic neonatal lung injury (CNLI) is characterized by severe inflammation, arrest of lung development and pulmonary hypertension (PHT), in common with severe bronchopulmonary dysplasia. Chronic exposure to elevated concentrations of CO<sub>2</sub> (hypercapnia) may limit lung inflammation.

**Objectives:** To examine the preventive effects of moderate (MH) or severe hypercapnia (SH) on BLEO-induced CNLI.

**Methods:** Rat pups received BLEO (1 mg/kg/d i.p.) or saline vehicle from post-natal days 1-14 while being exposed to FiCO<sub>2</sub> 0.05 (PaCO<sub>2</sub> 70 mmHg; MH), FiCO<sub>2</sub> 0.07 (PaCO<sub>2</sub> 90 mmHg; SH) or normocapnia (NC). Inflammation was assessed by tissue counts of immunoreactive macrophages (CD68) and neutrophils (MPO). PHT was assessed by echo-Doppler measurement of pulmonary vascular resistance (PVR), right ventricle (RV)/left ventricle+septum (LV+S) weight ratio and percentage medial wall thickness (%MWT) of pulmonary resistance arteries. Markers of lung development included weight, mean linear intercept, tissue fraction, secondary crest and peripheral vessel counts.

**Results:** SH, but not MH, attenuated BLEO-induced macrophage influx and prevented PHT, as evidenced by normalized PVR and significantly (p<0.01 vs. BLEO+NC) decreased RV/LV+S and %MWT. Neither SH nor MH affected BLEO-induced neutrophil influx, inhibited lung growth, septal thinning, impaired alveolarization or pruning of peripheral blood vessels.

**Conclusions:** SH prevented PHT, which we speculate was the result, in major part, of inhibited macrophage influx. Neither influx of neutrophils nor pruning of peripheral arteries appeared to contribute significantly to PHT in BLEO-mediated CNLI. *Funded by the CIHR.*

### 1921

#### The distribution of lung aeration at different positive end-expiratory pressure levels in newborn rabbits

Melissa Siew<sup>1</sup>, Marcus Kitchen<sup>2</sup>, Arjan te Pas<sup>3</sup>, Megan Wallace<sup>1</sup>, Muhammad Islam<sup>2</sup>, Naoto Yagi<sup>4</sup>, Kentaro Uesugi<sup>4</sup>, Stuart Hooper<sup>1</sup>. <sup>1</sup>The Ritchie Centre, Monash Institute of Medical Research, Clayton, Victoria, Australia; <sup>2</sup>School of Physics, Monash University, Clayton, Victoria, Australia; <sup>3</sup>Department of Pediatrics, Division of Neonatology, Leiden University Medical Center, Leiden, Netherlands; <sup>4</sup>SPRING-8, JASRI, Hyogo, Japan

**Background:** Very preterm newborns with respiratory distress at birth demonstrate increased end-expiratory lung volumes when ventilated with positive end-expiratory pressure (PEEP). However, the regional distribution of ventilation is unknown, especially if PEEP is not held constant but altered as occurs during face mask removal.

**Aim:** To determine the how the distribution of ventilation changes between different PEEPs

**Method:** Rabbit pups (28dGA) were delivered by c-section and mechanically

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ventilated with a peak inflation pressure of 35cmH<sub>2</sub>O and a sequence of PEEP. The PEEP sequences were (A) 0-5-10-5-0cmH<sub>2</sub>O, (B) 5-10-0-5-0cmH<sub>2</sub>O and (C) 10-5-0-10-0cmH<sub>2</sub>O. Phase contrast X-ray imaging was used to image and analyse the distribution of aeration.

**Results:** In sequence A and B, upper lobes (U) were more aerated than lower lobes (L) at functional residual capacity (FRC) throughout the ventilation period (A: 10PEEP U vs L - 70.5±2.9% vs 55.7±3.3%, p<0.05; B: 10PEEP U vs L - 70.9±1.5% vs 56.8±2.8%, p<0.05). Tidal volume (VT) aerated U and L similarly until the volume of the lungs at peak inflation (VPIP) achieved >70% of maximal lung volume (p>0.05). Once VPIP was >70%, VT aerated L more than U (A: U vs L; 22.3±3.7% vs 30.3±3.6%, p<0.05; B: U vs L; 20.4±1.6% vs 26.9±1.7%, p<0.05). Sequence C ventilated differently; FRC was only different between lobes at 0PEEP (p>0.05) and VT lacked difference at 10PEEP despite VPIP >70% (p<0.05).

**Conclusion:** At FRC, U are better aerated than L at different PEEP levels. During inflation, the VT was distributed more to lower lobes than upper lobes after the lungs were fully aerated. This is not observed if lungs were initially aerated with a very high PEEP.

## 1922

### Hospitalization for bronchiolitis in very preterm infants without broncho-pulmonary dysplasia

Brigitte Fauroux, Jean-Christophe Rozé, Christine Guillermet-Fromentin, Isabelle Glorieux, Latif Adamon, Massimo Di Maio, Daniela Anghelescu, Didier Pinquier, Benoit Escande, Christophe Elleau, Jean-Bernard Gouyon. *Pediatric Pulmonology and Inserm UMR-S 938, AP-HP, Armand Trousseau Hospital, Paris, France Neonatology, Nantes University Hospital, Nantes, France Pediatric Intensive Care, Besançon University Hospital, Besançon, France Neonatology, Toulouse University Hospital, Toulouse, France Neonatology, Caen University Hospital, Caen, France Pediatrics, Milétrie Hospital, Poitiers, France Medical Affairs, Abbott France, Rungis, France Neonatology, Rouen University Hospital, Rouen, France Neonatal Intensive Care, Strasbourg University Hospital, Strasbourg, France Pediatrics, Bordeaux University Hospital, Bordeaux, France Neonatology, Dijon University Hospital, Dijon, France*

**Background:** Prematurity is a risk factor for viral bronchiolitis but few studies have analyzed hospitalization rates in very preterm infants without bronchopulmonary dysplasia (BPD).

**Aims and objectives:** 1) To determine the hospitalization rates for acute viral bronchiolitis in very preterm infants ( $\leq$  32 weeks gestational age, wGA) without BPD as compared to matched full-term infants during their first winter season and 2) to identify risk factors for hospitalization.

**Methods:** Observational prospective multicenter study, conducted during the 2008-2009 winter epidemic in 9 French regions. Infants were matched (1:1) for date of birth, gender and birth location.

**Results:** 498 infants (249 preterms, mean GA: 31.4±0.9 weeks and 249 full-terms) were included. Mean age of infants at enrollment was 2.8±1.6 months. Forty infants (35 preterms and 5 full-terms) were hospitalized for bronchiolitis, out of which 20 were RSV-positive (16 preterms and 4 full-terms). The hospitalization rates for overall bronchiolitis were 14.1% in the preterm group *versus* 2.0% in the full-term group (RR: 7.00, 95%CI: 2.79-17.57; p < 0.0001). The hospitalization rates for RSV bronchiolitis were 6.4% in the preterm group *versus* 1.6% in the full-term group (RR: 4.00, 95%CI: 1.36-11.80; p = 0.006). The number of hospitalizations increased significantly with male gender and the presence of siblings of  $\geq$  2 years of age at home.

**Conclusion:** Very preterm infants without BPD have a 7 and 4 fold increased risk of hospitalization for overall and RSV bronchiolitis respectively, as compared to full term infants. Male gender and siblings  $\geq$  2 years of age are additional risk factors for overall bronchiolitis hospitalizations.