240. Resuscitation and ventilation in the baby and infant

Neonatal resuscitation at the community level
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Introduction: Community Based New Born Care Program (CB-NCP) was piloted
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 the 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 (VHW/MCHW, 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 decision trees were developed for all levels of the knowledge of the 57 health facility staffs including doctors, 36 VHW/MCHW 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, VHW/MCHW and FCHV regarding the management of birth asphyxiated baby was 100% (N=57/57), 94% (N=43/46) 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 VHW/MCHW. Similarly, 49.1% (N=28/57) health workers, 50% (N=18/36) VHW/MCHW and 90.8% (N=128/141) 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
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Background: Despite of self-inflating bags (SIB) widespread use, studies have showed 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.

Methods: Two physiotherapists were asked to ventilate 2 lung models (neonatal/pediatric) using 3 SIBs (Hudson® 1, Laerdal® 2, CMS® 3) with 0, 5, 10, and 15L/min of oxygen inflow attached. A lung function monitor (CO2SMOpuls®) recorded inspiratory volume (Vi), peak inspiratory pressure (PIP), peak inspiratory expiratory pressure (PEF) 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 compared 0 and 15L/min, we found a significant increase in PIP in all neonatal SIB brands. Also, there was a difference in Ti delivered by neonatal Hudson® SIB.

Conclusion: We found great variability in ventilatory parameters depending on the oxygen inflow. The Ti, PIP, PEF, 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

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 0.7 ml/kPa) was ventilated with a mechanically operated SI bag (Mark IV Baby Resuscitator® plus Ambo-10 PEEP valve, Ambo, Denmark) and a manually operated T-piece resuscitator (Neopuff®, Fisher&Paykel, New Zealand) (Pep2=cmH2O, PEEP=cmH2O, Flow=8 l/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+, Novametrix, 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-maneau (SD) PEEP fell from 20 (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 (PEEP-PEEP, ΔP) increased and VT increased from 9.1 (6.6) to 11.2 (8.0) cmH2O (p<0.001). Using the T-piece PEEP fell from 20 (0.0) to 18.6 (0.5) cmH2O. PEEP, ΔP and VT were stable.

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

Methods: Study one: expired 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 transpulmonary pressure-time product (PTPdi), a measure of the work of breathing, was assessed at each VT level during the baseline and during the protocol phase. To measure PTPdi, esophageal and gastric pressures are measured and PTPdi calculated by integration of the transpulmonary 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: Study one: infants were of 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 6 ml/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, IQ4-24-332 cmH2O.min) was almost double that at 6 ml/kg (median 163, IQR 122-230 cmH2O.min). (p<0.01).

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
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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 (BPD), in vitro exposure to elevated concentrations of CO2 (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 ip) or saline vehicle from postnatal days 1-4 while being exposed to FiCO2 0.05 (PaCO2 70 mmHg; MH); FiCO2 0.07 (PaCO2 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) wall thickness (SMWT) 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/LS+SMWT. 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
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Background: PTPdi is an important parameter during ventilation in newborn animals. 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 how the distribution of ventilation changes between different PEEP levels.

Methods: Rabbit pups (28±3GDA) were delivered by c-section and mechanically ventilated using a pneumotachograph and the ventilator’s software; at least 80 breaths were recorded for each PEEP level. Study one: infants were of the median (range) gestational age 37 (36-39) weeks, had a median VTe of 5 (range 1.9-9.3) ml/kg; 50% of infants had a VTe outside the “normal” tidal volume range (4 to 6 ml/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 24-332 cmH2O.min) was almost double that at 6 ml/kg (median 163, IQR 122-230 cmH2O.min). (p<0.01).

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.

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ventilated with a peak inflation pressure of 35cmH2O and a sequence of PEEP. The PEEP sequences were (A) 0-5-10-0-5cmH2O, (B) 5-10-0-5-0cmH2O and (C) 10-5-0-10-0cmH2O. 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 - 22.4±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**

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**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 (≤ 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 ≥ 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 ≥ 2 years of age are additional risk factors for overall bronchiolitis hospitalizations.