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### RISK FACTORS ASSOCIATED WITH RESPIRATORY DISTRESS (RD) IN TERM NEONATES WITH AND WITHOUT AIR LEAK

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**Background:**Approximately 1% of newborn infants develop air leaks in the immediate neonatal period. It is hard to differentiate air leak syndromes from other respiratory problems on clinical presentation and examination. With changes in perinatal and neonatal care, risk factors for air leaks may be changing.

**Methods:**: During a 2 year period (Jan. '00 to Dec. '02) neonatal and maternal records of newborn infants presenting with respiratory distress and air leak were reviewed. These infants were matched to a control group without an air leak by birth weight, gender, and gestational age. Maternal data included age, parity, pregnancy and labor complications, type of induction, length of labor, type of delivery, and presence of meconium. Infant data included attendance of NICU staff at delivery, type of resuscitation, type of air leak, need for mechanical ventilation, use of tracheal toilet and direct or delayed admission to the NICU. The burden of illness was assessed using length of NICU stay, number of x-rays done and doses of antibiotics given. Statistical analysis was carried out using parametric and non-parametric t tests where applicable. A value of $p < 0.05$ was significant.

**Results:**The data below are presented as those with air leak and those without (mean ±2 S.D.). There were 27 infants in each group. The following maternal characteristics were significantly different: length of rupture of membranes 1158 ±60 min vs. 879 ±55 min ($p<0.01$), first stage of labor 694 ± 45 min vs. 472 ± 35 min ($p<0.01$), second stage of labor 95 ± 10 min vs. 73 1±3 min ($p<0.05$). All other maternal data were similar. In the air leak group, there were 13 right and 11 left pneumothoraces, 3 bilateral air leaks and 2 with mediastinal air. Two had needle aspiration, one was mechanically ventilated, and 2 infants had chest drains. The average number of chest x-rays in the air leak group was 3.2 ±1 vs. 1 ± 0.2 in the control group ($p<0.001$). The average length of NICU stay for the air leak group was 3 ±0.5 days vs. 2.25 ±0.2 days in the control group ($p<0.01$). 24 infants in the air leak group received more than four doses of antibiotics vs. 10 infants in the control group ($p<0.05$). All other infant data were similar.

**Conclusion:**Term infants who developed air leaks had a longer period of rupture of membranes prior to delivery and a longer duration of labor. The burden of illness was significantly higher for those infants with air leaks.

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### ASSESSEMENT OF WHITE MATTER ABNORMALITIES WITH MAGNETIC RESONANCE IMAGING IN CASE OF NORMAL CRANIAL ULTRASOUND AND POSITIVE ROLANDIC SHARP WAWES ON ELECTROENCEPHALOGRAPHY IN PRETERM INFANTS

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**Background:** White matter abnormalities in preterm infants are not always diagnosed on cranial ultrasound and are involved in abnormal neurodevelopmental outcome. Magnetic Resonance Imaging (MRI) can detect noncystic white matter abnormalities. The aim of this study was to determine the value of MRI at four months of age in preterm infants with normal cranial ultrasound but with persistent electroencephalographic (EEG) signs of brain injury with positive rolandic sharp wawes (PRSW).

**Methods:** It's a prospective study performed from June 1995 to May 2000 at the Children's Hospital of Toulouse. All preterm infants with normal or transient hyperechogenicity on cranial ultrasound and with persistent PRSW on EEG were included. MRI was performed at four months of age using T2 weighted sequences to see high-signal intensity of white matter and signs of abnormal myelinisation.

**Results:** 30 preterm infants born at a median gestational age of 29 weeks (range 26–33 wks) and with a median birth weight of 1189g (800–1750g) were included and had a median follow-up of 20 months. Only 4 infants had white matter abnormalities on MRI. Three out of 4 of these children had a severe motor handicap, one had a normal neurological assessment (Positive Predictive Value of 75%). The remaining 26 infants had a normal MRI . Three out of these 26 children had nevertheless a severe motor handicap (Negative Predictive Value of 88%). MRI sensitivity was 50% (3/6 infants with severe motor handicap had white matter abnormalities on MRI) and MRI specificity was 92% (1/24 infants with normal neurological assessment had white matter abnormalities on MRI ). Seven infants had transient hyperechogenicity on cranial ultrasound, 2/7 had white matter abnormalities on MRI.

**Conclusion:** MRI at four months of age doesn't always predict neurological outcome in case of previous normal cranial ultrasound but persistent PRSW on EEG.

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### SALIVARY CORTISOL AND PAIN PROFILES DURING NAPPY CHANGE IN NEONATAL CARE.

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**Background:** Infants in neonatal intensive care are exposed to an extremely stressful environment along with several potentially harmful or intrusive interventions as a part of their medical care. The aim of the present study was to investigate if infants exposed to neonatal intensive care have the same pattern of stress response as fullterm healthy infants.

**Methods:** Infants in neonatal intensive care with gestational age range 23–38 w. (NICU) (n=34) and infants with congenital heart disease 36–42 w. (CHD) (n=23) were compared to a group of healthy fullterm newborns (controls) (n=30). Salivary cortisol was measured at baseline and after a standardised nappy change. The premature infant pain profile (PIPP) and the neonatal infant pain scale (NIPS) were measured before, during, directly after, three minutes after and 30 minutes after the nappy change. The investigation was performed at two different occasions, on day 2–7 (1st) and on day 10–18 (2nd) respectively.

**Results:** NICU and CHD infants had significantly higher cortisol than controls at 1st baseline. At the 2nd occasion all three groups had significantly lower cortisol compared to 1st occasion. NICU infants had a significant decrease in cortisol after their 2nd nappy change compared to baseline which was not seen at 1st occasion or in CHD infants and controls. All groups had a significant increase in pain scores during both nappy changes. The highest pain scores were found in NICU and CHD infants ($p=0.000$ and 0.008 respectively). The CHD infants had the shortest duration of response to the nappy change. The NICU infants had a prolonged increase in pain score that sustained until the three minutes measure point at 1st occasion and until the 30 minutes measure point at 2nd occasion.

**Conclusion:** Infants exposed to neonatal intensive care (NICU and CHD infants) have a higher salivary cortisol during their first days of life than healthy fullterm infants. The NICU infants expressed a high and prolonged pain response to the nappy change. CHD infants on the other hand, expressed a high but shortlasting pain response to the nappy change. Our results show that infants exposed to neonatal intensive care have a different pattern of stress response than healthy fullterm infants.

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### THE EFFECT OF TIDAL VOLUME AND PEEP ON CO2 AND OXYGENATION DURING RESUSCITATION OF VERY PREMATURE LAMBS

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**Background:** Over-ventilation causing low arterial carbon dioxide levels (PaCO2) has been associated with the development of neonatal chronic lung disease and adverse outcomes. This may occur very soon after birth.

**Aim:** To investigate the effect on PaCO2 and oxygenation of very premature lambs resuscitated with different tidal volumes and PEEP.

**Methods:** Anaesthetised lambs delivered at 126 days gestation were randomised to 15 min resuscitation with 3 regimes: (1) Laerdal resuscitation bag (B) with 100% oxygen and no PEEP, (2) fixed tidal volume (VT) of 5 mL/kg, or (3) VT of 10 mL/kg, both delivered with a Babylog 8000 ventilator in volume guarantee mode with 8 cm H2O PEEP and variable FiO2. Frequent blood gases were measured and VT, mean airway pressure (Paw), minute volume (MV), ventilation rate (VR), respiratory system compliance (Crs) and alveolar/arterial oxygen difference (AaDO2) were recorded.

**Results:** Twenty lambs were studied. B (1) was associated with more variable VT and peak inspiratory pressures (PIP) compared to fixed tidal volumes (2 and 3). The lambs ventilated with 10 mL/kg were over-ventilated, those ventilated with 5 mL/kg were slightly under-ventilated. Those ventilated with the Laerdal bag had a mean VT of 7.5 mL/kg and were normocarbic. The different tidal volumes had little effect on oxygenation. PEEP improved oxygenation. The table shows the values at 15 minutes expressed as mean and SEM.

| Values at 15 Minutes | (1) Bag resuscitation | (2) Set $V_T$ 5 mL/kg | (3) Set $V_T$ 10 mL/kg |
|---|---|---|---|
| Tidal Volume (mL/kg) | 7.4± 0.6 | 4.9 ± 0.1 | 9.4 ± 0.03 |
| $PaCO_2$ (mmHg) | 49.9 ± 2.9 | 64.1± 5.6 | 27.9 ± 2.3 |
| pH | 7.23 ± 0.03 | 7.19 ± 0.03 | 7.42 ± 0.04 |
| Minute volume (mL/kg/min) | 449 ± 36 | 435 ± 23 | 467 ± 42 |
| AaDO2 | 480 ± 42 | 255 ± 81 | 241 ± 64 |
| Peak inspiratory pressure (mmHg) | 39.2 ± 2.4 | 34.3 ± 1.6 | 46.4 ± 3.9 |
| Mean airway pressure (mmHg) | 13.1± 0.8 | 16.5 ± 0.6 | 20.4 ± 1.0 |

**Conclusion:** Very premature lambs can be effectively resuscitated from birth using volume guarantee ventilation. Within minutes of birth different tidal volumes had a large effect on PaCO2 and no effect on oxygenation. Studies are needed to determine the appropriate tidal volume for resuscitating very premature infants to maintain acceptable levels of PaCO2.

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### CYTOMEGALOVIRUS IN BREAST MILK: DOES IT MAKE VERY PREMATURE BABIES ILL?

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**Background:** It is well known that babies often become infected with CMV from their mother's milk. It has been suggested that postnatal CMV infection in very premature babies causes illness but there have been inadequate controls.

**Primary Aim:** To determine, in very premature babies born in the Royal Women's Hospital, the incidence and severity of illnesses caused by CMV shed in their mothers' fresh unfrozen expressed breast milk (EBM).

**Methods:** Mothers of babies born at <32 weeks and <1250g were invited to join the study. Only CMV antibody +ve mothers were enrolled. EBM and babies' urine and saliva were collected weekly, until discharge, for culture. All new neonatal symptoms, signs and treatments were documented. Results: 247 mothers were approached, 202 consented. Mothers of 95 babies were CMV antibody +ve (47%). 88 babies and their 75 mothers were studied. The mean (SD) mothers' age was 29 (6) y, parity 2.2 (1.3), and babies' birth weight 937 (212)g, 33% were delivered vaginally, 47% were male and 30% twins. CMV was cultured from EBM deposit and supernatant starting at week 1 in 66% of the EBM that was culture +ve at any time. 33% of the babies grew CMV in urine or saliva starting about week 7. 97% of the CMV culture +ve infants had CMV culture +ve EBM. 66% of the CMV culture -ve infants had CMV +ve EBM.

| Neonatal Illnesses | CMV culture +ve | CMV culture -ve | p |
|---|---|---|---|
| Platelets <100,000 | 24% | 24% | NS |
| $O_2$ at 36 weeks | 28% | 17% | NS |
| Hepatomegaly | 3% | 2% | NS |
| Apnoea >3/hour or bagging | 52% | 49% | NS |
| CPAP episodes | 59% | 41% | NS |
| Abdominal distension episodes | 66% | 64% | NS |

**Conclusion:** About half the mothers of very premature babies are CMV antibody +ve. Two-thirds shed CMV in their EBM from the first week. 33% of the babies of CMV antibody +ve mothers grew CMV from the urine or saliva. They had no more signs or symptoms of illness than the babies who remained CMV culture -ve. Very premature babies with CMV acquired from mother's EBM did not have significantly more illnesses than babies from CMV antibody +ve mothers who were not infected.

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### INVESTIGATIONS OF THE F & P NEONATAL DRY VENTILATOR CIRCUIT IN HIGH FREQUENCY MODE ON THE DRAGER 8000 PLUS VENTILATOR

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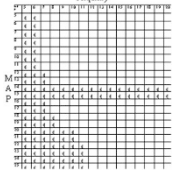
**Background** The Dräger Babylog 8000 ventilator calculates the delivered pressure from inspiratory and expiratory transducers. It alarms "pressure out of range" when the difference between the transducer exceeds 20 cm H2O in at least 20 of 30 measurements during the most recent second. To provide a neonatal ventilator circuit that delivers optimal temperature and humidity with no condensation in the inspiratory or expiratory limb Fisher and Paykel developed a dual heated neonatal breathing circuit No. RT235 (Dry Circuit). However the resistance of this circuit during high frequency ventilation (HFOV), when the circuit flow may rise to 30 L/min, causes alarms at certain ventilatory settings. These alarms rarely occurred with conventional circuits in our NICU.

**Aim** To find the mean airway pressure, frequency and amplitude at which the Dräger 8000 plus ventilator alarmed "pressure out of range" when used in HFOV mode with the Dry Circuit.

**Methods** Laboratory studies used the ventilator in HFOV mode with the F&P Dry Circuit attached to an MR290 humidifier chamber at 37oC with the circuit at 40oC. At a set mean airway pressure (MAP) the frequency and amplitude were altered from minimum to maximum and the settings where the "pressure out of range" alarmed were recorded. 6000 combinations of all pressures and frequencies were studied. These were repeated with the 36cm inspiratory extension removed from the circuit.

**Results:** The results are shown in the table, for frequencies from 5 to 20 Hz and MAP from 5 to 25 cm H2O. Loud speaker symbol indicates settings where the alarm sounded. The ventilator cannot be used at those settings with this circuit. It did not alarm at settings with no loud speaker symbol. Changing amplitude at any MAP and frequency combination did not cause the alarm. Removing the inspiratory extension tube did not alter the MAP and frequency combinations where the alarm sounded.




**Conclusion:** The F&P Dry Circuit can be used with the Dräger Babylog 8000 in HFOV mode at some MAP and frequency settings and not at others. This table can help clinicians decide which HFOV MAP frequency combinations can be used.