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## ABNORMALLY HIGH SURFACE TENSION OF LUNG SURFACTANT IN 2 INFANTS WITH SEVERE APPARENT LIFE-THREATENING EVENTS (ALTE)

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There is evidence to suggest that small airway closure may be involved in ALTE<sup>1</sup>. We present data from 2 infants who showed an abnormally high surface tension of their pulmonary surfactant. The first of these infants (MS) presented at 2 months of age with a history of severe cyanotic episodes starting one week prior to admission to our unit. One of these episodes could be documented and showed an extremely rapid fall in arterial oxygen saturation to 40%, but no apnoea. The second infant, a 4 month old boy, had had a history of 3 cyanotic episodes requiring intubation prior to admission to our unit. Both infants underwent bronchoscopy because of suspected upper airway obstruction (which could not be confirmed). During this procedure, a bronchoalveolar lavage (BAL) was performed. Analysis of the physical properties of the surfactant recovered from the BAL showed a normally shaped, but upward shifted hysteresis curve (analysis performed by bubble-surfactometry). Minimal surface tension was 21 and 32 mN/m, respectively. In two control infants of similar age, minimal surface tension was 9 and 11 mN/m, respectively.

These data suggest that an abnormally high surface tension of the pulmonary surfactant, facilitating small airway closure, may have been involved in the pathogenesis of the severe and otherwise unexplained ALTE in these infants. Whether this potential pathomechanism may also play a role in other infants with ALTE deserves further investigation.

<sup>1</sup> Poets CF, Samuels MP, Southall DP. The potential role of intrapulmonary shunting in the pathogenesis of hypoxemic episodes in infants and young children. *Pediatrics* 1992;90:385-391

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## EEG-SUPPRESSION FOLLOWING AUGMENTED BREATHS DURING APNEA

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Towards elucidation of mechanisms in initiation and termination of apnea and occurrence of bradycardia polygraphic recordings were performed to 10 preterm infants (mean gestational age 28.0 / range 26.1 to 32.1 weeks) at 36, 40, 44 and 52 weeks conceptual age including EEG, submental and diaphragmatic EMG, ECG, thoracic respiratory movements, nasal airflow,  $\text{tcpO}_2$  and  $\text{tcpCO}_2$ . A total of 148 apneas (>10 sec.) were recorded. 33 of them were mixed/obstructive events in N-REM-sleep and 66 in REM-sleep. Apneas followed a sigh in 16 of 106 REM apneas and 29 of 43 N-REM apneas (20 of the N-REM apneas were mixed with the inactive part preceding the obstructive part). A significant suppression of EEG-activity (Wilcoxon Rank,  $p < 0.05$ ) was found during mixed/obstructive N-REM apneas and inactive REM apneas. Moreover in N-REM-sleep a more distinct EEG-suppression, which was significant for the 8-13 Hz band (Wilcoxon,  $p < 0.05$ ), accompanied the apneas with an initial sigh in contrast to those without. Bradycardia occurred in 13 N-REM apneas and in 11 REM apneas also with a preference of mixed apneas in both sleep-phases (CHI-square,  $p < 0.005$ ). A parallel occurrence of initial sighs and bradycardia was found in 10 N-REM mixed apneas only.

The significant predominance and correlation of an initial sigh followed by an apnea, occurrence of bradycardia and EEG-suppression following a sigh at onset of apnea during N-REM-sleep apneas may point to different cardiorespiratory control mechanisms, possibly influenced by baroreceptor mechanisms via nucleus tractus solitarius, during that sleep-phase.

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## MATERNAL CIGARETTE SMOKING AND SUDDEN INFANT DEATH SYNDROME (SIDS) - RESULTS FROM THE LOWER SAXONY PERINATAL PROJECT

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Maternal smoking has long been identified as a risk factor for SIDS. However, almost all data available are based on information obtained after SIDS had occurred and are, therefore, potentially influenced by recall bias. In Lower Saxony, detailed information concerning the perinatal period, including information on the number of cigarettes smoked during pregnancy, is routinely obtained for almost all infants born in this region. The neonatal data sets from 190 SIDS cases who had died between 1985 and 1990 and in whom a full post-mortem had been performed were identified and compared to the data sets from 5920 random controls, frequency-matched for year of birth.

After adjustment for potential confounders (social class, birthweight, maternal age, ethnicity), smoking during pregnancy was still associated with a significantly increased risk of SIDS (odds ratio (OR) 2.7, 95% CI 1.7-4.5). There was a clear dose-effect relationship between the number of cigarettes smoked during pregnancy and the risk of SIDS: Adjusted ORs were 2.6 (1.5-4.4) for 1-10 cigarettes/day, 2.8 (1.8-6.0) for 11-20 cigarettes/day, and 6.9 (1.9-25.5) for >20 cigarettes/day.

These results confirm previous studies that maternal smoking is one of the most important amongst the potentially amenable risk factors for SIDS. The fact that the ORs found in this study, particularly for heavy smoking (>1 pack/day), were even higher than those observed previously, suggest that the true importance of this risk factor may be underestimated if data are obtained only after an infant has died of SIDS.

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## INTENSIVE CARE MANAGEMENT IN ASTHMATIC CHILDREN

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Management and outcome of children with severe acute asthma who were admitted for 8 hours or more to the PICU of the Royal Children's Hospital, Melbourne, during 1988 to 1991 was reviewed. A total of 180 children were admitted on 202 occasions; the medical records were reviewed for the following data: patient characteristics, treatment before admission to and in PICU, and outcome. In the referral hospital continuous nebulized undiluted salbutamol was given in 41% (in PICU 73%), 45% of the children did not receive any topic bronchodilators. IV steroids were given in 63% (in PICU 91%), iv salbutamol in 20% (in PICU 35%), iv aminophylline in 50% (in PICU 73%), but only in 8% as a continuous infusion (PICU 79%). Mechanical ventilation was necessary in 25% of admissions, in 65% the children have been intubated outside of PICU. Six patients died, representing a 3.0% mortality. It is concluded that delay in seeking medical care, under-diagnosis and undertreatment in the pre-hospital time and at the hospital, patient's delay in referral to hospital and delay in referral to a specialised children's hospital could contribute to mortality and morbidity. The excessive use of inhaled bronchodilators and systemic corticosteroids can avoid intubation and improves the outcome.

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## CHANGES IN THE CONCENTRATION AND DISTRIBUTION OF IMMUNOGLOBULIN PRODUCING CELLS IN SIDS PALATINE TONSILS.

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The palatine tonsils are strategically positioned to monitor both airborne and alimentary antigens. The deep crypts make a massive antigenic and mitogenic load possible, and they contain the cells necessary to produce an antibody response. Seventeen sudden infant death syndrome (SIDS) cases and 9 age matched controls, were examined immunohistochemically with regard to the presence of IgA-, IgM-, IgD-, and IgG-, as well as for the subtypes IgG<sub>1</sub>-, IgG<sub>2</sub>-, IgG<sub>3</sub>-, and IgG<sub>4</sub>-immunocytes.

| Table.           | SIDS (n=17)    | Controls (n=9) |
|------------------|----------------|----------------|
| IgG              | 20.21 ± 6.16*  | 7.72 ± 5.51    |
| IgA              | 3.85 ± 0.69*   | 1.87 ± 1.11    |
| IgG <sub>1</sub> | 18.38 ± 15.08* | 4.03 ± 3.00    |
| IgG <sub>2</sub> | 4.07 ± 2.79*   | 1.31 ± 0.79    |

\* $p < 0.01$  vs. controls. Number of cells/0.1mm<sup>2</sup> tissue area. No significant differences were demonstrated in the total number of IgM-, IgD-, IgG<sub>2</sub>- or IgG<sub>4</sub>-immunocyte groups. The immune response was primarily in the germinal center and interfollicular area indicating a recent stimulation of the palatine tonsillar immune system. The IgG-subgroup response profile may indicate a viral protein antigen.

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## EFFECTIVENESS OF INHALED NITRIC OXIDE ON LIFE-THREATENING PULMONARY HYPERTENSION AFTER CARDIAC SURGERY

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We assessed the effectiveness of inhaled nitric oxide (NO) in two patients, of six and two months of age, who developed severe pulmonary hypertension after corrective cardiac surgery for a complete atrioventricular canal. In the post-op period, attempts to wean the patients from ventilatory support resulted in marked increase of pulmonary arterial pressure (PAP) to suprasystemic levels, with severe desaturation and metabolic acidosis. Two life-threatening episodes did need cardiac resuscitation in the second patient. Short administrations of inhaled NO, at 30 parts per million (ppm), dramatically reduced the PAP to about half the systemic values in the first patient (systemic arterial pressure (SAP)=35/24 and PAP=44/33 before NO, and SAP=58/38 with PAP=31/19 after five minutes of NO treatment), while in the second patient NO showed a slower effect on PAP, but an immediate improvement of hemodynamics. Thus, continuous inhaled NO, at 10-50 ppm, was administered through the ventilator, with good clinical response. Electrochemical analysis provided on line monitoring of NO and nitrogen dioxide (NO<sub>2</sub>) concentrations. NO<sub>2</sub> did not exceed 1.6 ppm. Inhaled NO was tapered to the minimal effective concentration able to maintain low pulmonary pressures and normal oxygenation. Treatment with NO was stopped after 55 and 62 hours, respectively. No complications were noted. Methemoglobin levels ranged between 0.7-1.2% in case 1, and 0.1-5.1% in case 2. In the latter case, methemoglobin was directly correlated with NO concentration levels. Weaning was successful in both cases, with extubation performed on day 29 and day 17 post-op, respectively.

CONCLUSIONS: Inhaled nitric oxide at concentrations of 10-50 ppm exerts a potent dilatory effect on pulmonary vascular bed in children with congenital heart disease who present pulmonary hypertension after surgical correction. Although toxicity by NO and NO<sub>2</sub> seems to be negligible at these dosages, continuous on-line gas monitoring is recommended.