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CIRCADIAN VARIATION IN OXYGEN CONSUMPTION IN PRETERM INFANTS

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Aims: This study investigated the diurnal variation on oxygen consumption to determine the optimal time periods to obtain measurements representative of a 24-h measurement period in preterm infants.

Methods: Oxygen consumption (VO2) and carbon dioxide production (VCO2) were measured continuously over 24 hours using indirect calorimetry. Twenty-two very low birth-weight preterm infants with gestational age of 27 to 31 weeks were enrolled in the study. None of the selected infants were intubated, treated with CPAP or supplemental oxygen at the time of study. All infants were free of malformations and of major current clinical problems. Heart rate, respiratory rate, oxygen saturation, skin and rectal temperatures, and physical activity were monitored continuously.

Results: The averaged values of VO2 showed a circadian rhythm with a peak in the afternoon and a minimum during the night. There was no physical activity or environmental stress effect.

Conclusions: These finding indicating the possible existence of an endogenous circadian rhythm of VO2 in preterm infants beginning early after birth with a slight synchronization to the daylight cycles. Circadian rhythms of VO2 should be considered when VO2 values were extrapolated from short measurements periods.

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THE REPERTOIRE OF IGG EXPRESSING B-CELLS DEVELOPS MUCH SLOWER IN PRETERM THAN IN TERM INFANTS

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Background: Even very immature preterm infants in the first weeks of life develop a repertoire of B cells with IgG-type antigen receptors (1). Yet, the different kinetics of the postnatal evolution of B effector cells in preterm an term neonates are unknown.

Hypothesis: The variable (V) region gene diversity of the IgG repertoire and the somatic diversity increases slower in preterm than in term neonates.

Study design: Crossover observational study.

Methods: Heavy chain V-region genes coding for the antigen binding site of the IgG-type B-cell receptor were amplified, cloned and sequenced. The diversity of the V-region gene repertoire was determined from the percentage of different amplificates in the total number of amplificates. In addition, the number of somatic mutations per V-region gene was calculated.

Results: We analyzed peripheral blood samples of 8 preterm infants (GA 24–27 weeks, postnatal age 0–14 weeks) and of 16 term infants (postnatal age 0–16 weeks). In preterm infants V-region gene diversity increased slowly with postnatal age ($r=0.82$; $p<0.000$) from 30% at birth to 47% at 4 weeks, and to 82% at 12 weeks. In contrast, in term neonates already at two weeks of age diversity was higher than 80%. Furthermore the frequency of somatic mutations per V-region gene increased faster in preterm ($r=0.712$; $p<0.004$) than in term infants ($r=0.83$; $p<0.000$). Per postnatal week the accumulation of somatic mutations was three times higher in term than in preterm infants (0.12% per week vs 0.04% per week).

Conclusion: In the first weeks of life both preterm and term infants respond to environmental antigens. However, preterm infants are much slower in developing an IgG repertoire. (1) Bauer K et al. Diversification of Ig heavy chain genes in human preterm neonates prematurely exposed to environmental antigens. J Immunol 2002;169:1349–1356

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APOLIPOPROTEIN E GENOTYPE IN THE PERINATAL POPULATION

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Background: Apolipoprotein E (Apo E) has an important role in cholesterol and lipoprotein metabolism within the nervous system. The importance of different apolipoprotein E alleles in adult brain injury and neurological diseases has been well-described. Few investigators have examined the effect of the Apo E genotype at different ages.

Aims: To determine the frequency of the Apo E alleles within a population of births and to compare the allele frequency with published adult data.

Methods:< Healthy infants- blood was taken from the placenta of 371 anonymised healthy newborn infants at birth. Perinatal deaths- DNA was extracted from formalin-fixed paraffin embedded brain blocks of 242 perinatal deaths (PNDs) enrolled in the Scottish Perinatal Neuropathology Study. There were 179 stillbirths (SBs) and 63 early neonatal deaths (ENNDs). Apolipoprotein E alleles (ä2, ä3, ä4) were determined using PCR methodology. The frequency of alleles in each group was compared using the chi-squared test.

Results:

Cohort	ä2	ä3	ä4	Total alleles
Normal adults[1] (n=400)	66 (8%)	616 (77%)	118 (15%)	800
Healthy newborns (n=371)	63 (8%)	538 (72%)	141 (19%)	742
PNDs (n=242)	61 (13%)	351 (73%)	72 (15%)	484
ENNDs (n=63)	15 (12%)	86 (68%)	25 (20%)	126
SBs (n=179)	46 (13%)	265 (74%)	47 (13%)	358

Chi square- normal adults vs liveborns $p=0.082$, trend ä2=0.93, ä3= 0.049, ä4 =0.024 Chi square- normal adults vs PNDs $p=0.037$ (SBs $p=0.046$, ENNDs $p=0.101$) Chi square- liveborns vs perinatal deaths $p=0.01$ (SBs $p=0.008$, ENNDs $p=0.426$)

Conclusions: We have demonstrated an excess of the ä2 allele among infants dying before or shortly after birth compared to healthy newborns and adults, suggesting an increased mortality of Apo E ä2 carriers in the perinatal period. Liveborn infants have a higher frequency of the ä4 allele than the adult population and this decline between birth and middle age may reflect an increased mortality in Apo E ä4 carriers. [1]Cunning AM, Robertson FW. Polymorphism at the apolipoprotein-E locus in relation to risk of coronary disease. Clinical Genetics 1984;25:310–3

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METALLIC SHIELDS DECREASE NEONATAL EXPOSURE TO ELECTROMAGNETIC FIELDS IN INCUBATORS

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Aims: Newborns lie close to the electric engines of the incubator, and they are exposed to high electromagnetic fields. We measured whether magneto-absorbing panels reduce at a sufficient extent the high level of electromagnetic field (EMF) to which newborns are exposed in incubators.

Methods: We found very high electromagnetic field values: up to 88.4 mG in common incubators and up to 357.0 mG in the transport incubator. Values highly diminished by increasing the distance from the motor. We measured EMF at mattress level in three neonatal incubators with and without magneto-absorbing panels put between the electric engine and the mattress. These panels were: a) 5 mm sweet iron; b), c), d): respectively one, two and three sheets of 0.3 mm mu-metal.

Results: The use of the above panels reduced significantly the EMF. No significant attenuation difference was recorded using one, two or three folds of mu-metal, or a single fold of sweet iron. One, two or three sheets of mu-metal reduced EMFs respectively of 77%, 82% and 84.3% ; the reduction with sweet iron was 80%.

Conclusion: EMF values measured in incubators were much higher than those to which the general population is exposed. The use of magneto- absorbing panels reduces significantly the level of EMFs to which neonates are exposed.

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VALIDATION OF A NEW CLINICAL PAIN SCALE FOR FULL-TERM BABIES

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Aim: Inadequate assessment of pain may be due to lack of an easy reliable scale. We developed and validated a pain scale (ABC scale) for term babies based on acoustic features of crying.

Methods: The scale consisted of three different cry parameters: a) pitch of the first cry; b) rhythmicity of the crying bout; c) continuity of the crying. These parameters were previously found to be correlated with pain level by spectral analysis of crying. We validated the scale using 90 healthy term babies undergoing routine heelprick. To assess its sensitivity we examined the distribution of the ABC scores in the seven levels (0–6) of the scale in 50 babies. Concurrent validity was assessed comparing pain values obtained with our scale with those obtained with another pain scale in the same group of babies. To assess specificity we compared the ABC scores during a heelprick performed without analgesia with those of the preliminary phase in a group of 20 babies, and then with those of another group of 20 babies who received analgesia during heelprick. To assess inter-rater reliability and the internal consistency of the scale items, we asked four neonatal nurses to score 28 crying episodes recorded during routine heel-pricks. To assess the intra-rater reliability, they scored these cries a second time, at a distance of two months. To assess feasibility of the scale we asked them to use it for a 10 day period during painful procedures and analysed their approval or disapproval.

Results: Sensitivity and specificity: a) analgesic/non analgesic comparison $p<0.0001$; b) pain/sham comparison: $p<0.0001$). Concurrent validity: Spearman rho= 0.91. Internal consistency: Cronbach's alfa= 0.76. Inter -rater reliability: Cohen's kappa for multiple raters = 0.83. Intra-rater reliability: Cohen's kappa = 0.85. All nurses that used it, defined the scale "good".

Conclusion: The ABC scale proved to be simple and reliable for assessing pain in healthy non intubated term newborns.

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PAIN CONTROL AND NURSING DURING MINOR PAINFUL PROCEDURE IN NEWBORNS: A RANDOMIZED CONTROLLED TRIAL

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Background: Minor painful procedure are very frequent in nursery; control of pain can be obtained by farmacological and non farmacological methods. We investigated the effect of different nursing during procedure with a randomized controlled trial.

Methods: Forty-four healthy, full term (2500–4000 g) newborns (21 male, 23 female) were assessed during heel lance procedure for newborn screening. The newborns were randomly allocated with a computer-generated random numbers list to receving "nurse care" or "mother care" for the procedure. In both cases newborns were nursed in a standard way before, during and after the procedure, the person giving care being the only difference between the two groups. In order to obtain blindness of assessors, video tapes of the face of the baby were recorded. A nurse unaware of the person who gave care analyzed the tapes and gave a validated score of pain (Neonatal Facial Code System, NFCS [Grunau & Craig 1987]) 4 times (at the beginning of the procedure, during blood sampling, at the end of the procedure, and 10 minutes after). Results are expressed as mean and SD (table); analysis were performed with Mann-Whitney U non parametric test because of skweness of distributions.

Results: Facial scores at the end of the procedure were reduced in the "mother group" compared to the "nurse group" (3.00 ± 2.77 vs 0.45 ± 1.33, $P < 0.001$). At other observation points, the differences in facial scores between the two groups of newborns did not reach statistical significance. Duration of crying during the blood collection was not significantly different (96.0 ± 58.2 vs 73.8 ± 43.5). Mother care was effective in reducing responses to pain upon heel lance in the period following completion of the procedure in healthy full term newborns.

Conclusion: This non farmacological strategy can be useful for reducing behavioural responses to minor procedural pain in newborns.