

# 1105 OUTCOME AFTER INFLICTED TRAUMATIC BRAIN INJURY IN SHAKEN BABY SYNDROME: NEUROSURGICAL APPROACH

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F Menegazzo, M Bua, M Rosa Rizzotto, E Sgaravatti, P Facchin, R Faggini. *Department of Pediatrics, Child Abuse Unit, University of Padova, Padova, Italy*

**Background and Aims** Shaken Baby Syndrome (SBS) is a severe form of child abuse caused by violent shaking leading to severe head injuries, causing mild-severe long-term disabilities and death. The study aims to explore medium/long-term consequences of SBS comparing children undergoing neurosurgery with hematoma evacuation/cranioplasty with those with hematoma evacuation or no surgery.

**Methods** A cohort of 21 children with SBS, admitted to Pediatric Department/Padua Hospital (2003–2011), was followed-up. Each clinical record was reviewed collecting information on onset, acute course, ophthalmologic examinations, neuroimaging, treatment and procedures, family history and social background. Cases were followed-up at 3, 6 and 12 months after trauma, every year. The assessment included fundus evaluation and visual function, neuro-radiological exams (MRI).

**Results** 21 cases were reviewed (M:F=2:1.1), 12 foreigners, 9 italians. Mean age at onset: 5.7 months (range 1.2–18). Mean age at last follow-up evaluation: 30.4 months (range 5–82). Mean follow-up duration: 24.6 months (range 1–73.5). In acute phase 8/19 underwent neurosurgical intervention and 1/21 underwent eye surgery. 20/21 showed retinal hemorrhages, 21/21 cerebral hemorrhages, 11/21 cerebellar hemorrhages, 5/10 spinal subdural hematoma, 4/21 skull fractures, 6/21 other body region fractures. At last follow-up evaluation resulted: 2/21 hemiplegia, 1/21 paraplegia, 1/21 tetraplegia, 2/21 cortical visual impairment, 3/21 visual field deficits, 4/21 strabismus. 10/21 underwent cognitive and behavioural assessment demonstrating in 6 cases global delay and in 4 cases delay in specific functions (locomotor, eye and hand coordination, performance scale). Surgical procedure's video will be shown.

**Conclusions** SBS may influence child development and therapeutic surgical approach seems crucial.

# 1106 IMPACT OF WARMED INHALED GAS FROM THE MECHANICAL VENTILATOR ON ESOPHAGEAL TEMPERATURE DURING WHOLE BODY HYPOTHERMIA FOR HYPOXIC-ISCHEMIC ENCEPHALOPATHY

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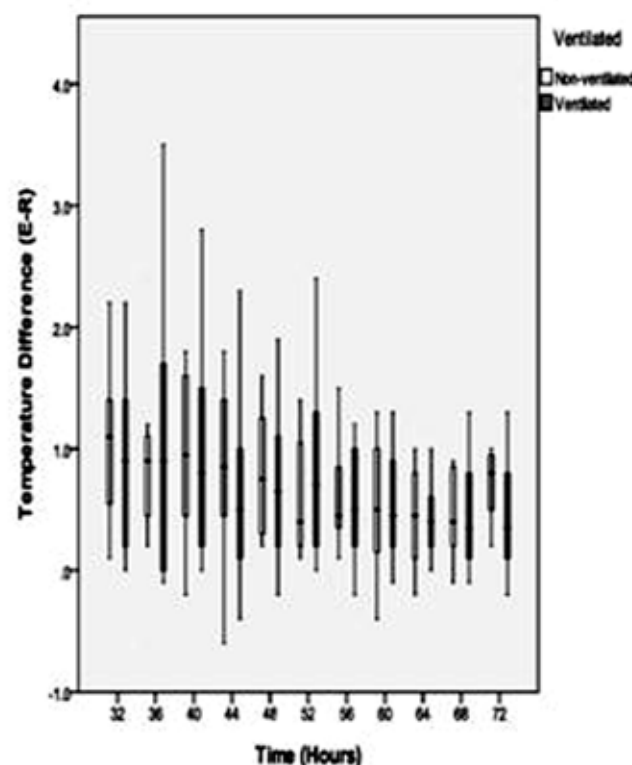
<sup>1</sup>S Sarkar, <sup>2</sup>SS Sarkar, <sup>3</sup>I Bhagat, <sup>1</sup>R Dechert, <sup>1</sup>SM Donn. *<sup>1</sup>Department of Pediatrics, Division of Neonatal-Perinatal Medicine; <sup>2</sup>Research Volunteer, Division of Neonatal-Perinatal Medicine, University of Michigan Health System; <sup>3</sup>Pediatrics, St Joseph Mercy Hospital, Ann Arbor, MI, USA*

During whole body cooling (WBC), the core temperature is monitored with either an esophageal or a rectal probe. Most infants are usually on mechanical ventilation while receiving hypothermia. As the temperature in the esophagus responds rapidly to changes in the ambient temperature, inhalation of warmed gas from ventilator during hypothermia may lead to overestimation of ventilated patients' actual temperature, causing automated cooling devices to overcool patients well below set temperature targets.

**Objective** We determined if the esophageal temperature recordings during therapeutic WBC differ between ventilated and non-ventilated infants.

**Methods** Twenty-two consecutively cooled infants had simultaneous esophageal and rectal temperatures recorded every 4 hours during 72 hours of WBC. The later was deemed to be actual core temperature. Other clinical monitoring and treatment during hypothermia were as per established protocol.

**Results** Fourteen infants received mechanical ventilation throughout cooling. The remaining 8 infants were on ventilator initially but got extubated and were not on ventilator during 32 to 72 hours section of WBC. Esophageal temperatures were significantly higher than simultaneous rectal temperatures ( $p \leq 0.01$  at each time point) for all 22 infants. However, the esophageal temperatures across every 4 hour time points during 32 to 72 hours section of WBC did not differ between the ventilated (n=14), and non-ventilated (n=8) infants. The magnitude (median, IQR) of the difference between esophageal and rectal temperatures were also similar between the 2 groups.



Abstract 1106 Figure 1 Comparison of E-R (in centigrade) between 2 groups

**Conclusions** Warmed inhaled gas does not interfere with the esophageal temperature during WBC.

# 1107 CONTINUOUS CARBON DIOXIDE MONITORING USING FEATURES OF NEONATAL ELECTROENCEPHALOGRAPHY

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<sup>1</sup>C McKeering, <sup>1</sup>P Gaydecki, <sup>2</sup>A Hendrickson, <sup>2</sup>C Jennings, <sup>2,3</sup>S Victor. *<sup>1</sup>School of Electrical and Electronic Engineering, University of Manchester; <sup>2</sup>Newborn Intensive Care Unit, Central Manchester University Hospitals NHS Foundation Trust; <sup>3</sup>School of Biomedicine, University of Manchester, Manchester, UK*

**Background** The continuous monitoring of partial pressure of blood carbon dioxide ( $p\text{CO}_2$ ) in premature babies has proven to be challenging. Spot measurements of  $p\text{CO}_2$  can be performed by taking a blood sample. However the frequency of such measurements is limited by their invasiveness.

**Aim** We aim to develop a continuous non-invasive method of predicting  $p\text{CO}_2$  using features of the preterm electroencephalography (EEG) signal.

**Methods** A regression model was trained on eight 12 hour EEG recordings that contained 22 blood gas measurements in total. All measurements were obtained from babies born before 28 weeks' gestation and less than 72 hours old. The duration of EEG quiescence

(interburst interval) and relative power of delta EEG frequency band values surrounding the point  $p\text{CO}_2$  measurements were averaged using a specified smoothing window.

**Results** It is shown that by combining the measurements of both a defined period of EEG interburst interval and the relative power of delta EEG frequency band using a multivariate linear regression model, a prediction of  $p\text{CO}_2$  can be performed. The automatic removal of mechanical artefact and artefact due to other external influences is demonstrated. A regression coefficient ( $R^2$ ) of 0.64 is obtainable using both the interburst and delta relative power as predictors for  $p\text{CO}_2$ . All variables are significant to within  $p < 0.05$ . A section of continuous prediction of  $p\text{CO}_2$  using EEG showing correlation with simultaneous transcutaneous carbon dioxide measurement is demonstrated.

**Conclusion** The ability to provide a novel non-invasive continuous monitoring of  $p\text{CO}_2$  in newborn preterm babies is discussed.

# 1108 AN EVALUATION OF THE USE OF ENTERAL NUTRITION DURING HYPOTHERMIA TREATMENT FOR PERINATAL HYPOXIC ISCHAEMIC ENCEPHALOPATHY

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<sup>1</sup>E Tillqvist, <sup>2</sup>B Thyagarajan, <sup>3</sup>V Baral, <sup>4</sup>B Hallberg, <sup>5</sup>B Vollmer, <sup>6</sup>M Blennow. <sup>1</sup>Karolinska University Hospital, Karolinska Institutet, Stockholm, Sweden; <sup>2</sup>Neonatal Medicine, Princess Anne Hospital; <sup>3</sup>Paediatric Neurology, University of Southampton, Southampton, UK

**Background** There is widespread variation in enteral feeding practices of infants receiving therapeutic hypothermia (cooling) following hypoxic ischemic encephalopathy (HIE). We compared the safety and efficacy of early versus delayed enteral feeding during cooling.

**Methods** Retrospective case control study (January 2009 – December 2011). Cooled infants at Karolinska Hospital, Stockholm (KH) received early enteral feeding and were compared to similar infants at Princess Anne Hospital (PAH) Southampton, who had delayed feeding (controls). Infants also received early parenteral nutrition in both centres.

**Results** A complete data set was available for 28/37 infants at PAH compared to 51/51 neonates at KH. Mean baseline parameters at PAH/KH were birth weight (3404.80/3723 g), male/female ratio (50/55 %), umbilical arterial pH (7.1/7.04) and base deficit (–15.65/–12.03).

There were differences in enteral feeding rates at PAH/KH (20.1/91.0%). The mean volume of enteral feeds (mls/kg/day) at PAH/KH on days 1–4 were: 0/2.1, 0.2/6.1, 1.8/10.1, 1.9/17.1.

There were also differences (PAH/KH) in mean time to establishing full nasogastric tube feeding (5.9/7.2 days) achieving full oral feeds (7.45/10.1 days) and breast feeding rates at discharge (56/70.2%). The mean length of stay was 9.77/14.7 days (PAH/KH).

One baby developed spontaneous intestinal perforation at KH but none developed necrotising enterocolitis in either centres.

**Conclusion** Feeding practices during hypothermia varies between centres. Early enteral feeding during hypothermia is safe and not associated with any additional morbidity. However, delayed introduction of enteral feeds does not delay the time to reach full enteral feeds or prolong the length of stay at hospital.

# 1109 TOTAL BODY HYPOTHERMIA AND CIRCULATING BIOMARKERS OF LIVER FUNCTION

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<sup>1</sup>D Gardner, <sup>2</sup>S Sanka, <sup>1</sup>A Pawaletz, <sup>2</sup>H Muniraman, <sup>3</sup>C Jennings, <sup>3</sup>A Vayalakkad, <sup>3,4</sup>S Victor, <sup>2</sup>P Clarke, <sup>1,5</sup>MA Turner. <sup>1</sup>Neonatal Unit, Liverpool Women's NHS Foundation Trust, Liverpool; <sup>2</sup>Neonatal Unit, Norfolk and Norwich University Hospitals NHS Foundation Trust, Norwich; <sup>3</sup>Newborn Intensive Care Unit, Central Manchester University Hospitals NHS Foundation Trust; <sup>4</sup>Developmental Biomedicine Research

Group, University of Manchester, Manchester; <sup>5</sup>Women's and Children's Health, University of Liverpool, Liverpool, UK

**Background and Aims** Total body hypothermia (cooling) improves outcome in hypoxic-ischaemic encephalopathy (HIE). This study tested the hypothesis that cooling affects the liver by examining whether cooling during HIE was associated with differences in clinically relevant biomarkers of hepatic metabolism.

**Methods** Clinical records in 3 centres were searched for babies with HIE and umbilical artery pH at birth  $\leq 7.0$  born between 01/07/2006 and 30/06/2011. Each centre adopted routine cooling on a different date. The results of blood tests reflecting hepatic metabolism measured according to clinical practice within 7 days of birth were collected. ANOVA was used to assess the associations between extreme values of each analyte, HIE grade and the use of cooling and to calculate estimated marginal means for each condition.

**Results** 127 babies were identified including 31 with Grade 1 (42% cooled), 65 with Grade 2 (80% cooled) and 31 babies with Grade 3 (90% cooled). Grade of HIE was associated with maximum AST [HIE1: mean 180 (s.e. 120); HIE2: 367 (85); HIE3: 850, (123)], maximum prothrombin time [HIE1: 18 (3); HIE2: 22 (2); HIE3: 36 (4)] maximum bilirubin [HIE1: 117 (9); HIE2: 108 (8); HIE3 68 (15)] and minimum albumin [HIE1: 28.5 (0.9); HIE2: 23.6 (0.7); HIE3: 20.1 (1)] but not with maximum ALT or maximum APTT. Cooling was not associated with any variables.

**Discussion** Clinically graded HIE was associated with markers of liver function. Cooling did not modify these associations. Liver and brain may have different susceptibilities to hypoxic-ischaemia or different responses to cooling.

# 1110 IMPLEMENTING A THERAPEUTIC HYPOTHERMIA PROGRAM FOR THE TREATMENT OF PERINATAL HYPOXIC ENCEPHALOPATHY: EXPERIENCE FROM A UK TERTIARY NEONATAL CENTRE

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K Povazai, E Molnar, M Chilton, A Kapetanakis. Neonatal Medicine, Evelina Children's Hospital Guy's and St Thomas' Hospital NHS Foundation Trust, Kings Health Partners, London, UK

**Introduction** Hypoxic-ischaemic encephalopathy (HIE) is a leading cause of neonatal morbidity and mortality. Therapeutic hypothermia (TH) is an effective neuroprotective treatment. In the U.K NICE endorsed selected TH use in 5/2010. Access to treatment is increasing. Our institution is a tertiary neonatal unit serving South-East London perinatal network. We designed and implemented a TH program with established clinical governance procedures and a rolling training program followed by the treatment of the first patient in 8/2009.

**Aim** To present our experience in implementation of our TH program.

**Methods** Review of clinical records, aEEG, EEG and MRI of the infants treated with TH from 8/2009–3/2012.

**Results** 44 infants with moderate or severe HIE were treated. Mean GA: 40 weeks (36–42 weeks). 61% outborn (N=27) 10/27 from outside SE-London. Treatment commenced at median age: 2.5h for inborns. Outborns commenced passive cooling. On admission 30% of the outborns had rectal temperature  $< 30^\circ\text{C}$  48% of patients were treated for seizures before TH, 16%. During treatment 1 infant developed arrhythmia (PEA) after phenytoin. One infant required extended TH for seizures. 77% survived to discharge. 93% had brainMRI performed.

**Conclusions** Successful introduction of a TH program requires an on-going education program and established clinical governance procedures. Access to TH and transport procedures should be further improved. TH should ideally be provided in centres equipped to provide neurocritical intensive care able to address the complex