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**Re: MMS Technology featured at the 2011 Pediatric Academic Society/Asian Society for Pediatric Research Joint Meeting - Denver, Colorado USA April 30th - May 3rd, 2011**

Poster Presentations scheduled for May 1st, 2011 @ 4:15pm

**[2911.129] Brain Temperature Measurement by Radiometric Thermometry in Normal Term Infants and Infants Treated with Moderate Systemic Hypothermia for Hypoxic-Ischemic Encephalopathy**

***W. Thomas Bass, Gretchen Brayman, Kenneth L. Carr, James Shaeffer, Robert C. Allison, Frank Lattanzio. Pediatrics, Eastern Virginia Medical School, Children's Hospital of The King's Daughters, Norfolk, VA; Meridian Medical Systems, Woolwich, ME; Physiological Sciences, Eastern Virginia Medical School, Norfolk, VA.***

BACKGROUND: Moderate systemic hypothermia (HT) has been shown to decrease death and severe disability in infants with hypoxic-ischemic encephalopathy (HIE). Currently, rectal temperature monitoring is used to determine the temperature setpoints for treatment with HT. Experimental studies have shown significant differences between rectal and brain temperature that could be important in the clinical setting. We have shown in an animal model that noninvasive radiometric thermometry (RadT) is capable of measuring brain temperature at a depth of 1.5 centimeters. Knowledge of actual brain temperature during treatment with HT may allow better determination of optimum degree of cooling.

OBJECTIVE: To compare rectal temperature measurements obtained by conventional techniques to simultaneous brain temperature measurements obtained by RadT in normal term infants and infants with HIE treated with HT. DESIGN/METHODS: The study was approved by the institutional review board and parental consent was obtained for subject entry. Normal newborns Conventional rectal temperature measurements and 30-second RadT measurements from seven cranial positions were obtained as soon as possible after delivery and hourly thereafter for the first 6 hours of life in twenty normal newborn infants. Race, gender, hair color and density, and thermal environment were noted. Infants with HIE treated with HT RadT, rectal, esophageal, and cooling blanket water temperatures were continuously recorded during the 72-hour cooling period and rewarming period in 18 infants undergoing HT. Standard NICU care and follow-up were otherwise provided.

RESULTS: RadT measurements closely approximated rectal temperature in normal infants. Insignificant variations were noted in various cranial positions. In infants treated with HT, RadT measurements were consistently warmer than rectal and esophageal temperatures by 1 to 3 degrees C° during cooling, however the temperature curves converged during the rewarming period.

CONCLUSIONS: RadT brain temperature measurements approximate rectal temperature in normal infants and in infants with HIE after rewarming. RadT measurements during the active

cooling phase of HT indicate the brain is consistently warmer than rectal or esophageal temperatures. Funded by: NIH SBIR Grant No. 2R44HD048138-02 E-PAS20112911.129

**Session:** Poster Session: Neonatal Neurology (4:15 PM - 7:30 PM) **Date/Time:** Sunday, May 1, 2011 - 4:15 PM **Room:** Exhibit Hall F - Colorado Convention Center **Board:** 129 **Course Code:** 2911

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**[2911.131] Preclinical Development of a Non-Invasive Radiometric Thermometry Device To Measure Brain Temperature in Infants with Hypoxic-Ischemic Encephalopathy**

***Frank Lattanzio, Kenneth L. Carr, James Shaeffer, Robert C. Allison, Richard Kelley, W. Thomas Bass. Physiological Sciences, Eastern Virginia Medical School, Norfolk, VA; Meridian Medical Systems, Woolwich, ME; Pediatrics, Eastern Virginia Medical School, Children's Hospital of The King's Daughters, Norfolk, VA.***

BACKGROUND: Moderate systemic hypothermia (HT) has been shown to decrease death and severe disability in infants with hypoxic-ischemic encephalopathy (HIE). Currently, rectal temperatures are used to determine the temperature setpoints for clinical HT protocols. Knowledge of actual brain temperature in HT may allow a better optimization of cooling and provide insight into clinical outcomes.

OBJECTIVE: To develop an external noninvasive radiometric thermometry (RadT) system capable of measuring brain temperatures to a depth of 1.5 cm and then to simultaneously compare rectal and RadT brain temperatures in instrumented miniature swine undergoing HT. DESIGN/METHODS: Skull/brain phantoms were constructed to refine RadT design to permit real-time measurements to 1.5cm. Terminal experiments were then performed on anesthetized swine undergoing accelerated HT protocols. Swine were instrumented with a 7 channel multi-level thermistor probe to track brain temperature gradients. We then created a model to ensure that the resolution and depth of RadT measurements were appropriate. In a separate experimental series, 3 brain temperature probes were placed subdermally and at 0.75 and 1.5cm deep into the left hemisphere to validate measurements made using surface-based RadT in swine undergoing accelerated HT protocols. All swine had rectal and tympanic membrane temperature measurements collected.

RESULTS: A real-time RadT device was constructed that detected temperature changes to at least 1.5 cm deep and was capable of resolving existing brain temperature gradients. During HT experiments, RadT measurements more closely temporally tracked brain temperature changes and absolute brain temperatures than either rectal or tympanic membrane temperatures. These differences were more pronounced during cooling and re-warming segments of HT protocols. Rectal temperatures lagged and were lower by several $^{o}$ C during cooling and initial re-warming compared to RadT.

CONCLUSIONS: There are significant differences between actual swine brain temperatures and rectal temperatures during accelerated HT protocols. These temperature differences may have to be accounted for when developing and monitoring clinical HT protocols and in evaluating the factors that may influence clinical outcomes. Funded by: NIH SBIR Grant No. 2R44HD048138-02 E-PAS20112911.131

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