

A Research Program to Examine Evidenced-Based Practices in Newborn Thermoregulation

Authors: M Schindler, C Herzner, I Berlet, S Dahlmann, F Loersch, and T Schaible, Universitätsklinikum Mannheim, Mannheim, Germany; Lynn Lynam, GE Healthcare Perinatal, Laurel, MD, USA; Petra Heep, GE Healthcare, Rodgau, Germany

BACKGROUND: Thermoregulation is a critical component of neonatal care. Yet many of the practices surrounding thermoregulation have not been re-tested despite the fact that the frontier of viability has markedly changed over the last 4 decades. Maintaining a neutral thermal environment (NTE) whereby oxygen consumption is minimized for compromised newborns is one foundation of care for this population. Environmental temperatures impact mortality rates. There is no easy way to determine whether an infant is in his or her NTE. Rather clinicians have extrapolated data from historical studies that have determined the correlation between O₂ consumption, rectal temperature, and skin temperature. The problem with these studies is that they were conducted on infants that did not reflect the demographics of the infant population in modern NICUs. Less than 20 years ago, the survival of infants less than 750 grams was a rare event. Now it is a common occurrence and some of these data need to be re-examined to determine if the temperatures thought to represent NTE are still valid and to determine if the methods of driving heater control algorithms are influenced by these demographic differences. With this foundation as an overview, one should realize that approximately 50% of the nurseries in the world practice a baby-control philosophy to thermoregulation while the rest practice an air-control philosophy. Yet is the evidence base all that is should or could be? Does the data show that one approach is better for the baby than the other?

OBJECTIVE: A multidisciplinary research group has been convened at Universitätsklinikum Mannheim. A staged approach to investigation of thermoregulatory practices has been developed. During the first phase, the primary goal is to evaluate and compare the thermal and physiological homeostasis of very low birthweight (VLBW) infants during two methods of heating control (baby control versus air control conditions) during the first week of life. Specific primary outcome measures will be the effect of heating method on skin temperature, core temperature, heart rate, heart, respiratory rate, blood pressure, SpO₂, pH, PaO₂, and PaCO₂.

Future stages will examine outcomes in closed versus open bed care during the first week of life, the effect humidity (on whom should it be used, how long should it be used, and how much should be used) in consideration of potential infection risks, and optimal methods for preserving thermal balance from birth in the delivery room and during intrahospital transport from the delivery room to the neonatal intensive care unit.

DESIGN/METHODS: During phase one, thirty preterm infants under 1500 grams will be subjected in randomized fashion to the following conditions: Giraffe (baby control mode) versus Giraffe (air control mode). The Giraffe bed will be set-up and pre-warmed according to manufacturer's guidelines in closed bed/incubator/manual mode, using temperature recommendations from the Comfort Zone™ chart. An admission temperature will be documented on the nursing observation chart. Admission procedures will be conducted in their usual manner. Central skin temperature will be measured by a single disposable Giraffe temperature thermistor will be placed midline, midway between the umbilicus and xiphisternum when the infant rests supine or in the paravertebral, lower thoracic region when the baby is prone. Prone skin temperature will be measured by a single reusable YSI neonatal thermistor placed on the left heel and connected to a Marquette temperature TRAM module. Both thermistors will be covered with a hydrogel reflective foil disk supplied by GE Healthcare, Life Support Solutions. The initial thermal goal will be to maintain central skin

temperature at 36.5 degrees C in both groups and rectal temperature within a range of 36.8 to 37.3 degrees C. Added humidity will be controlled at 60-80% for the 7-day period of data collection. Variations in the level of humidity will be handled statistically as a covariate and examined for strength of relationship before data manipulation. Rectal temperature will be monitored at least every 4 hours.

For the purposes of phase one, several specific hypotheses are proposed:

1. An infant's skin thermistor temperature (central) will be stable (± 0.3 degrees C) relative to set point (36.5 degrees C) when the infant's thermal environment is managed by baby (patient) control mode.
2. An infant's skin thermistor temperature (central) will be stable (36.5 degrees C ± 0.3 degrees C) when the infant's thermal environment is managed by air (manual) control mode in incubator mode.
3. There will be no difference in the relationship between an infant's central skin temperature (abdomen) and peripheral skin temperature (left heel), whether the infant is nursed in baby (patient) control or air (manual) mode.
4. There will be no difference in the relationship between infant's skin temperature (central) and core temperature (rectal), whether the infant is nursed in baby (patient) control or air (manual) mode.
5. There will be a relationship between infant's skin temperature and thermograms as measured by IR camera.
6. There will be no difference in blood gas parameters (pH, oxygen tension, and carbon dioxide tension), whether the infant is nursed in baby (patient) control or air (manual) mode.
7. There will be no difference in physiological parameters such as heart rate, respiratory rate, oxygen saturation, and blood pressure whether the infant is nursed in baby (patient) control or air (manual) mode.
8. There will be a relationship between the length of environmental perturbation, infant's skin temperature, core temperature, physiological parameters, and blood gas parameters during invasive procedural interventions.

RESULTS/CONCLUSIONS: To date, data on 11 babies in phase one has been completed. Upon collection of data from 20 babies, a repeated-measures MANOVA will be performed on all data. It is anticipated the findings derived from this multidisciplinary investigation will strengthen the evidenced-based approach to clinicians. It is our opinion that both nurses and physicians must be fully aware of evidenced-based practices and to be prepared to develop research protocols necessary to implement best practices.