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The Effects of Holding on Stress and Bonding in Mother-Infant Dyads During Therapeutic Hypothermia

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A. Introduction

Therapeutic hypothermia (TH) is a standard of care intervention that decreases death and disability in newborn term infants at risk for hypoxic brain injury. It involves placing the newborn infant on a cooling blanket for 72 hours in the Neonatal Intensive Care Unit (NICU). While TH has unmistakable neurological benefits to the newborn, prior research conducted with nurses and parents of infants treated with TH indicates that the experience is psychologically traumatic.[1-3] Specifically, both groups identified parents' inability to touch and hold their infants during TH as a major source of stress.

Past research demonstrates that the experience of being a patient in the NICU is associated with neonatal stress.[4-6] Longitudinal studies show lasting effects of NICU-associated stress on infants as measured by persistent alterations in cortisol reactivity at eight months of age.[7] It is likely that this stress profile also applies to infants who undergo TH while in the NICU. However, the association between TH and infant stress has not been studied quantitatively.

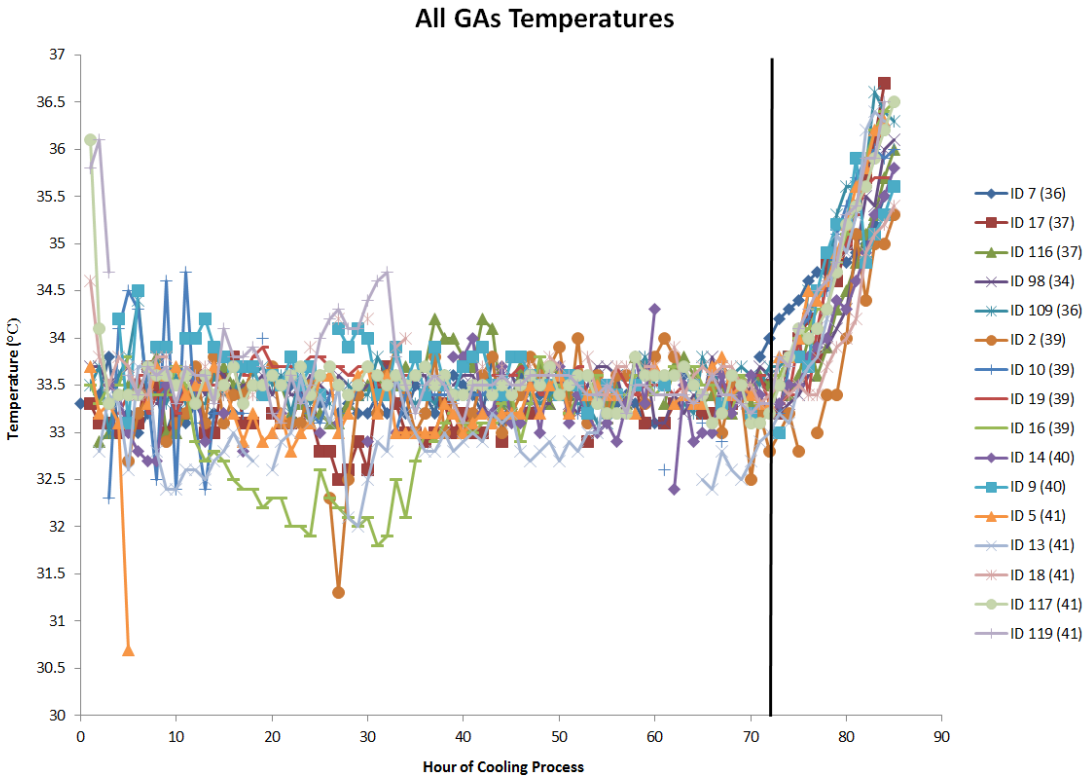
A complementary field of study has examined maternal holding as a therapeutic intervention for maternal and neonatal stress. Kangaroo, or skin-to-skin care, is widely used to facilitate mother-infant bonding and has been shown to have an analgesic effect on infants[8] and cortisol lowering effects[9] on mothers and infants. Likewise, oxytocin, a hormone produced by the pituitary gland and associated with maternal-infant bonding and stress reduction, has been shown to increase in mothers while they hold their infants[14]. It is unclear whether holding has the same effects during TH because skin-to-skin contact is not possible and morphine is often used to suppress infants' discomfort and shivering. The first specific aim of the present study is to evaluate the safety of allowing mothers to hold their infants during the TH protocol. The second specific aim is to investigate whether holding impacts mothers' and nurses' perception of stress during TH treatment.

B. Specific Aims and Significance

Specific Aim 1: Assess the safety and feasibility of a new holding protocol for stable infants undergoing therapeutic hypothermia in the NICU. We hypothesize that there will not be a significant change in temperature variation, and there will be no increase in adverse events during holding.
Specific Aim 2: Assess mothers' and nurses' qualitative experience related to the holding during hypothermia intervention using a questionnaire with a combination of closed and open-ended questions. We hypothesize that mothers and nurses will respond positively to the opportunity to hold during hypothermia.

Adverse Effects: Given the vulnerability of infants in the NICU, potential adverse effects of the holding intervention and the monitoring strategy for these adverse effects are outlined here.

1. Holding during hypothermia could result in unintentional rewarming of the infant due to the proximity of the normothermic mother. In order to prevent rewarming, a thermal barrier will be placed between the mother and infant and the infant's esophageal temperature will be monitored every two minutes during holding and the intervention stopped early if the infant rewarms more than 1°C. Retrospective review of 16 medical records of infants treated with hypothermia at Maine Medical Center with gestational ages ranging from 34 -40+ weeks document a usual range of temperatures during cooling from 33-34°C (goal is 33.5°C)[10]. The research team has made the determination that the intervention will be stopped early if the infant rewarms more than 1°C based on this data.



2. Holding during hypothermia could result in dislodging of central lines. Only experienced NICU nurses will move the infant from the isolette into the mother's arms with assistance from a member of the research team. Critically ill infants that are intubated are considered too great a risk for accidental extubation and are therefore excluded.

C. Materials and Methods

Study Design: This is a single center safety study of the feasibility of a novel holding protocol for infants undergoing therapeutic hypothermia.

Study Population: As this is a pilot study to investigate concept and feasibility, a convenience sample of ten infants and their mothers in the MMC NICU being treated with TH will be recruited for the study according to the following criteria:

Inclusion criteria:

- Infant with gestational age ≥35 weeks treated with therapeutic hypothermia
- Infant **without** seizures in the first 24 hours on EEG
- Infants who are clinically stable on bubble CPAP, nasal cannula or who have no respiratory support. This criterion MUST be confirmed by the Attending Neonatologist.
- Infants with all types of vascular access are eligible.
    - Use appropriate caution and attention to peripheral arterial lines and central lines (PICC, UAC, UVC, tunneled central catheters)
- Informed consent for research study signed by mother who is at MMC.

Exclusion criteria:

- Intubated status
- Use of inhaled nitric oxide
- Persistent pulmonary hypertension of the newborn
- Presence of seizures on EEG
- Use of vasopressors or paralytic agents
- Presence of chest tubes, wound vacuum or drains
- Neonatal abstinence syndrome

Eligibility for enrollment and consent process: Dr. Craig is the Neonatal Neurologist involved in the clinical care of all infants at MMC treated with therapeutic hypothermia. Dr. Craig will describe the research study to parents of infants who meet the inclusion criteria. Dr. Craig and/or the co-investigators will obtain signed informed consent from the mother on behalf of herself and from the mother or father on behalf of the infant.

Intervention: After obtaining consent, on the second or third day of hypothermia treatment, consented mothers will be assisted with holding their infants for a single 30-minute period. Holding will take place with the assistance of the NICU nurse according to the protocol developed for this study (see attached). The infant's vital signs will be measured before, during and after holding. Esophageal temperatures will also be measured and recorded every 2 minutes during holding to ensure that holding does not impact the infant's body temperature. If temperature deviations +/-1°C occur or if the infant becomes hypoxic with oxygen saturations below 90%, the holding session will be terminated and the baby will be returned to his or her isolette. Prior observation of therapeutic hypothermia indicates that 1 degree Celsius is the average temperature deviation that occurs in typical therapeutic hypothermia sessions. [10]

Implementation of questionnaires:

- Parent Questionnaire:
  A questionnaire using the Likert scale will be administered on paper to mothers 30-60 minutes after completion of the holding session. Results will be linked by a patient identification number to the hormonal samples. Responses to the questionnaire will be entered into a password-protected REDCap database.
- Nurse Questionnaire:
  The nurse questionnaire starts with an alteration of consent and consists of a combination of closed and open-ended questions that will be provided to the nurse on paper at completion of the holding procedure. The nurse's questionnaire will be identified by the case number that is assigned to the mother-infant dyad to protect their identities. The results of the questionnaire will be entered into a password-protected REDCap database.

Data collected:

As all of the patients treated with therapeutic hypothermia in our NICU are recorded in the Maine Medical Center Neonatal Encephalopathy REDCap database (IRB NET976245-1), we will use the same data for this holding study. In addition to the data already recorded in the REDCap database, we will also record the infant's current medication doses during holding, temperature recording taken at 2 minute intervals during holding and their vital signs before, during, and after holding. These vital sign recordings include temperature, heart rate, blood pressure, oxygen saturation and respiratory rate. If the infant does not have an arterial line in place, blood pressure will be measured every 10 minutes using a blood pressure cuff so as not to agitate the infant.

D. Analytical Methods

- Safety
  Frequency of adverse events (as defined above) will be compared in this experimental cohort to data from historical controls in our therapeutic hypothermia database.
- Questionnaires
  Answers from questions using a Likert scale will be simplified into nominal agree/disagree categories and compared with χ^2 test or Fisher's Exact Test as applicable. Open-ended responses will be analyzed by Thompson's general inductive technique.

E. References

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