Abnormal Thermal Patterns in Very Preterm Infants Associated with Infection and Maternal Smoking

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No Conflicts of Interest to Declare
Very Preterm Infants
Thermoregulation in Very Preterm Infants

Heat Loss to Environment
- Radiation
- Convection
- Evaporation
- Conduction

Nonshivering Thermogenesis
- Hypothalamus
- Release of norepinephrine in BAT
- Activates 5'-monodeiodinase
- Stimulates UCP1
- Uncouples mitochondrial oxidation from phosphorylation

Increased sympathetic activity
- TSH release
- $T_4$ converts to $T_3$

Peripheral vasoconstriction
- Immature in Preterms
- Heat is Conserved & Sent to Central Organs

Heat is Produced

Immature in Preterms

Model of Immature Thermoregulation in Very Preterm Infants
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Plot of Foot Temperature > Abdominal Temperature for First 12 Hours of Life
Purpose:

To examine Abdominal (Central) and Foot (Peripheral) temperature in 30 very preterm infants over their first 2 weeks of life in relationship to morbidity and mortality using an exploratory, case study approach.

- IRB Approval at Duke University Health System
- < 29 Weeks GA
- 500-1200 grams at birth
- Enrolled by 6 hours of age
- Within subject and between subject analysis
• Abdominal, Foot and Inside Incubator Temperature every minute X 2 weeks (20,000 measures)

• Calculated Central-Peripheral Temperature Difference

• Medical Record Data

Veriteq Data Loggers (Vaisala)
Results: Demographics

- 22 Infants
- Mean BW 860 grams (±135)
- Mean GA 26 weeks (±1.2)
- 68% Female (15)
- 68% African American (15)
- 27% White (6)
- 5% Hispanic (1)
Skin Temperature

- Abdomen: Mean $36.53° \pm 0.19°C$ (36.09-36.81)
- Foot: Mean $35.91° \pm 0.28°C$ (35.10-36.40)
Evaluating Central-Peripheral Temperature Difference

- Range: 0-70.7%

- 2 Week mean over all infants ranged 7.32%-38.51%
<table>
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<th>BW</th>
<th>Sex</th>
<th>Race/Ethnicity</th>
<th>NEC</th>
<th>Infection</th>
<th>Maternal Smoking</th>
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</table>
T006: 38.51%

- 880 grams, 27 weeks, Female, AA infant
- Maternal Smoking during pregnancy
- History of PROM
- Very unstable
- NEC at 33 days of age (CONS)
Day 1

Day 2

Day 3

Day 4

Day 5

PRBC transfusion
1130-1320 mins

2 Doses of Indocin for PDA

5 attempts at PICC placement
Feedings/CPAP

Ampicillin & Gentamicin

Multiple apnea & bradycardia

Hydrocortisone started for hypotension and adrenal insufficiency

Day 6  Day 7  Day 8  Day 9  Day 10

Minutes since birth

De.degrees in Centigrade
## Results

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<td>Infection</td>
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Conclusions

• Infants <1500 grams have varied amounts of time with foot warmer than core throughout their first 2 weeks of life.

• Monitoring central and peripheral temperatures and their difference appears to be an important biomarker that can be used in clinical care
Larger Study

- Sample of 200 infants in 3 NICUs
- Longitudinal body temperature until discharge
- Risk Factors
  - Race/ethnicity
  - Smoking History
  - Maternal Infection
- Acute morbidity
  - Infection
  - NEC
- Chronic Morbidity
  - Development
  - Brain/Gut pathology
Biomarker

CP Temp Difference
\[ \uparrow \% \text{ of minutes} \]
FT > AT = "marker"

Mechanism

Dysregulated or Immature ANS

Indicators:
* CP Temp Diff Temperature
* HRV ECG

Maternal Smoking

Increased \% minutes with FT >AT

Predicts ANS dysregulation

Increased morbidity
* Infection
* NEC

ANS dysfunction brain & gut
* SIDS
* Neuro
* Autism
* ADHD
* GI: IBS, Crohns
* Immunosupression
Questions?

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