Nurse-initiated Enhancement Program on Reducing the Time Required to Achieve Normothermia in Hypothermic Preterm Infants at Their Initial Stabilization Period in NICU

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Introduction

- Neonatal hypothermia - ↑ Mortality ↑ Morbidity
- Preterm infants are particularly at risk of hypothermia

Patient Chart Review (May-July 2017)

<table>
<thead>
<tr>
<th></th>
<th>Number of infants</th>
<th>Percentage of the admitted preterm infants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild hypothermia (36°C-36.4°C)</td>
<td>5</td>
<td>25%</td>
</tr>
<tr>
<td>Moderate hypothermia (32-35.9°C)</td>
<td>9</td>
<td>45%</td>
</tr>
<tr>
<td>Severe hypothermia (&lt;32°C)</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>14</td>
<td>70%</td>
</tr>
</tbody>
</table>

Range of temperature of this group of infants: 35.2 to 36.4°C

Average time required for these group of infants to return to normothermia is 3.96 hours
Objectives

(1) To determine the effect of the intervention program on shortening the average time required for hypothermic preterm infants to achieve normothermia after NICU admission

(2) To reinforce NICU nurses’ knowledge on neonatal thermoregulation

(3) To detect any risk factor that associate with the average time required for hypothermic preterm infants to achieve normothermia after NICU admission
Intervention (From Nov 2017)

Enhance Staff’s knowledge by Small Group Education Sessions

New workflow

Pretest-posttest designs

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### Checklist for Prevention & Management of Hypothermia of Preterm Infants

**Initial Stabilization after birth in NICU**

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Specimen label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase NICU room temperature &gt;25℃</td>
<td>Specimen label: <strong>D</strong>.</td>
</tr>
<tr>
<td>Prepare all NICU equipment (linen, towel, scale, thermoprobe, stethoscope bell, ECG leads, BP cuff)</td>
<td>Specimen label: <strong>D</strong>.</td>
</tr>
<tr>
<td>Warming the preparatory pack for IV access and UA/UV catheterization either under the radiant warmer or in the incubator</td>
<td>Specimen label: <strong>D</strong>.</td>
</tr>
<tr>
<td>Switch on humidifier of ventilator circuit if needed</td>
<td>Specimen label: <strong>D</strong>.</td>
</tr>
</tbody>
</table>

**Interventions**

<table>
<thead>
<tr>
<th>Temp. Range</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal temp. (36.5-37.3℃)</td>
<td>✓ Keep the plastic wrap/NeoHelp on &amp; cotton hat from LW if BW&lt;1.2kg</td>
</tr>
<tr>
<td>Cold stress (36-36.4℃)</td>
<td>✓ Plastic wrap/NeoHelp not a/v; Cotton hat not a/v</td>
</tr>
<tr>
<td>Moderate hypothermia (32-35.9℃)</td>
<td>✓ Attach temp. probe then switch to servo mode</td>
</tr>
<tr>
<td>Severe hypothermia (&lt;32℃)</td>
<td>✓ Take an axillary temperature to correlate with skin temperature (post-admission 30 minutes)</td>
</tr>
</tbody>
</table>

**Skin temp monitoring frequency**

- Chart in CIS
- Q30mins x2, then Q1H Q15mins until 34℃, then Q30mins until 36℃, then Q1H

| Date & Time: ______________________ |

**Additional interventions**

- Apply warm towels if using incubator (e.g., ATOM)
- Use of infrared light warm unit (*Remove towel & keep the wrap if providing infrared light warming unit or radiant warmer*)
- Rapidly warm till 34℃ then slow rewarm
- Discuss with doctor to delay all treatment/procedure (UV/UA insertion) if possible until temp≥36℃
- Use of heat shield (double shield)
- Provide warm fluid using fluid warmer

Plastic wrap/NeoHelp removed when skin/axillary temp: ______________________
(1) Prepare for admission

- Increase NICU room temperature >25°C
- Pre-warm all equipment (linen, towel, scale, temp probe, stethoscope bell, ECG leads, BP cuff)
- Warming the preparatory pack for IV access and UA/UV catheterization either under the radiant warmer or in the incubator, including:
  - 4 packs of single-use Chlorhexidine Solution
  - 2 ampoules of 20ml H2O for Injection
  - 1 pack of prefilled syringe NS
- Switch on humidifier of ventilator circuit if needed

(2) Re-warming Measures According to Severity of Hypothermia

- Preterm infant’s axillary temperature <36.5°C?

  - Severe hypothermia (<32°C)
  - Moderate hypothermia (32-35.9°C)
  - Cold stress (36-36.4°C)

- Normal temperature (36.5-37.3°C) with birth weight <1.2 kg

- No need to dry up the baby

  - Keep the plastic wrap/Neohelp (if present) and cotton hat from delivery room

  - Provide extra heat by:
    - Provide humidification system (e.g., Humidifier box)
    - Apply warm towels if using incubator (e.g., ATOM)
    - Use of infrared light warming unit
    (* Removed towel & keep the wrap if providing infrared light warming unit or radiant warmer)

- Discuss with doctor to delay all treatment/procedure (UV/UA insertion) if possible until temperature return to at least 36°C
- Use of heat shield (double shield)
- Consider to provide warm fluid using fluid warmer
- Rapidly warm till 34°C then slow

(3) Temperature Monitoring

- Continue monitor and document skin temperature:
  - Cold stress to Normal temperature → Q30mins x2, then Q1H
  - Moderate to Severe Hypothermia → Q15mins until 34°C, then Q30mins until 36°C, then Q1H
  *Correlated the skin temp with the axillary temp → Post-admission 30 minutes, then every shift or in doubt

(4) Outcome: Achieve Normothermia

Target Temperature: 36.5–37.3°C within 5 hours of admission
Result—Effectiveness of Education Sessions

Mean score of Pre-test and Post-test on Nurses’ Knowledge on Thermoregulation

<table>
<thead>
<tr>
<th></th>
<th>Pre-test</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean score</td>
<td>40%</td>
<td>92%</td>
</tr>
</tbody>
</table>

(p< 0.001, paired t-test)
Result

Average Time Required for Hypothermic Infants to achieve Normothermia

May-July 2017
Nov 2017 – Jun 2018

(p< 0.001, 95% CI 1.30-3.97, independent t-test)
## Result

### Effect of Maturity and Intervention Program on the Average Time Required for Hypothermic Preterm Infants to Return to Normothermia

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>143.0 ( ^a )</td>
<td>5</td>
<td>28.6</td>
<td>16.2</td>
<td>0.000</td>
</tr>
<tr>
<td>Intercept</td>
<td>241.2</td>
<td>1</td>
<td>241.2</td>
<td>136.6</td>
<td>0.000</td>
</tr>
<tr>
<td>Intervention</td>
<td>72.1</td>
<td>1</td>
<td>72.1</td>
<td>40.8</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Maturity</td>
<td>55.3</td>
<td>2</td>
<td>27.6</td>
<td>15.6</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Intervention * Maturity</td>
<td>35.9</td>
<td>2</td>
<td>17.9</td>
<td>10.1</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Error</td>
<td>56.4</td>
<td>32</td>
<td>1.765</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>400.1</td>
<td>38</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>199.5</td>
<td>37</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( a. \) R Squared = .717 (Adjusted R Squared = .673)

After controlling the body weight, both intervention (\( p < 0.001 \)) and gestational age (\( p < 0.001 \)) were significant factors that associate with the time required for hypothermic preterm infants to achieve normothermia.
Conclusion

- This program can significantly reduce the average time required for hypothermic preterm infants to achieve normothermia during initial stabilization period in NICU.
- In the future, it is recommended to evaluate the sustainability of the program by keep monitoring incidence of hypothermia as a quality indicator.