A BEST PRACTICE TOOLKIT FOR NICU’S EVERYWHERE

Cooling Infants with HIE

Program Checklists & Clinical Resources

Created by
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MSN, NNP-BC

BABY BRAINS ARE OUR BUSINESS
Consulting, Courses & Conferences
# TABLE OF CONTENTS

## INTRODUCTION
- Why I created this toolkit .......................................................... 3

## SECTION 1 – Program Evaluation Tools ................................. 4
- Quick Assessment Quiz ............................................................ 5
- Comprehensive Program Checklist ........................................ 6
- Staff Education Documentation ............................................. 12
- QI Metrics ............................................................................. 14

## SECTION 2 – aEEG Education + Tools ...................................... 15
- Easy aEEG Interpretation Guides .......................................... 16
- Sample aEEG Tracings ........................................................... 18
- Online aEEG Resources ....................................................... 21

## SECTION 3 – Additional Online Cooling Resources ................ 22
- Website Directory ................................................................... 23
- Brain Cooling Course Flyer .................................................... 24

## BONUS SECTIONS
- Webinar Recording Notes Pages ........................................... 27
- California Cooling Program Guidelines (Numbered Letter) ......... 29
- CA CPQCC HIE Clinical Guidelines ...................................... 36

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WHY I CREATED THIS TOOLKIT

Just in case we haven’t met before, I thought I would take a minute to introduce myself and explain a little bit about how I got to be so passionate about the neonatal neuro-monitoring and neuro-protective care, including neonatal hypothermia therapy.

My name is Kathi Salley-Randall, and I started my NICU career working in NICU’s in California as a Transport Nurse, Bedside Nurse, Preceptor Nurse Educator, Clinical Nurse Specialist, and Nurse Practitioner. Now I am lucky enough to spend most of my time teaching and traveling. This has allowed me the opportunity to help NICU’s, from Bangkok to Beirut, implement brain-care tools like aEEG and cooling into their daily practice.

I first learned about aEEG brain monitoring in the early-2000’s, which was right around the same time that Therapeutic Hypothermia was THE HOT TOPIC in Neonatal Medicine. As I attended conferences to learn about aEEG I watched the evolution of Therapeutic Hypothermia from a potential treatment to the standard of care for infants with HIE. So, in my mind, aEEG and Brain Cooling will always go together.

Another highlight of the last few years has been my role as the NeuroNICU Program Consultant at Lucile Packard Children’s Hospital at Stanford University. We have worked together on everything from equipment selection, bedside staff training, policy development, documentation changes, creating an annual international conference, a program data-base and so much more!

As an independent program consult for NICU’s around the world, I would love to help your NICU too. Just reach out and let’s chat about how we can work together!!!

Now let’s dive in to this toolkit!!!

Kathi
SECTION 1

PROGRAM ASSESSMENT TOOLS

PROGRAM EVAL + EDUCATION TRACKING + MORE
QUICK COOLING PROGRAM ASSESSMENT

Instructions: Evaluate your Cooling Program. Choose Yes or No.
Count of your # of YES Answers today. Reassess in 6 months and compare your results.

☐ YES  ☐ NO  Do you use a standardized neuro-exam tool?

☐ YES  ☐ NO  Do you review your cooling cases and explore any variance from your eligibility criteria?

☐ YES  ☐ NO  Do you use aEEG or vEEG for all infants undergoing hypothermia?

☐ YES  ☐ NO  How do you train your staff to read and document aEEG?

☐ YES  ☐ NO  Is every cooled infant evaluated by a Pediatric or Neonatal Neurologist before cooling or within 24 hours of admission.

☐ YES  ☐ NO  Is every cooled referred to Pediatric or Neonatal Neurology for follow up after discharge?

☐ YES  ☐ NO  Is every cooled evaluate by a feeding specialist before discharge?

☐ YES  ☐ NO  Do you offer cooling on transport using a servo-regulated device?

☐ YES  ☐ NO  Do you track when cooling is initiated and the time to reach target core temperature and review this data regularly?

☐ YES  ☐ NO  Do you provide families with emotional and spiritual support during cooling?

☐ YES  ☐ NO  Do you provide families with educational materials about therapeutic hypothermia?

☐ YES  ☐ NO  Do you offer your staff at least 8 hours of training when they join your cooling team?

☐ YES  ☐ NO  Do you offer ongoing staff education to those who care for cooling babies?
# THERAPEUTIC HYPOTHERMIA PROGRAM CHECKLIST* & PLANNING

Use this check list to: assess your practice, identify needs, describe your current scope of practice and provide rationale for any deficiencies.

<table>
<thead>
<tr>
<th>Section* (CCS-NL)</th>
<th>Criteria Met (Y/N/NA)</th>
<th>Yes: Describe current practice</th>
<th>No: Describe plan for meeting standard</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A PROGRAM</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Be a CA CCS Paneled NICU*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Meet AAP criteria for Level III Care*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Use a servo-regulated device</td>
<td>(Name model/manufacturer)</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Birth rate and/or catchment area supports an average of 6 treated patients per year*</td>
<td>Active Program: Include birth rate data, number of patients treated in last 3 years</td>
<td>New Program: If starting a program, document # of patients referred for cooling in last 3 years</td>
</tr>
<tr>
<td>5.</td>
<td>If less than 12 patients/year – formal relationship with regional center*</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>A</strong></td>
<td>6. Written &amp; Approved Clinical Guidelines for providing Therapeutic Hypothermia for Infants with Moderate to Severe HIE</td>
<td>Date:</td>
<td></td>
</tr>
</tbody>
</table>

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*If you are a CCS-Paneled NICU in California providing Therapeutic Hypothermia to Infants with HIE these services and practices are required per CCS NL 06-1116
<table>
<thead>
<tr>
<th>Section* (CCS-NL)</th>
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</tr>
</thead>
</table>
| A 7.              | Clinical Guidelines includes:  
   a. method for patient selection  
   b. patient management  
   c. neuromonitoring standards  
   d. neuroimaging standards |                               |                                      |
| A 8.              | Established plan to review:  
   a. Adverse events  
   b. Perform Quality Assurance review  
   c. Conduct Quality Improvement initiatives |                               |                                      |
| **PERSONNEL**     |                        |                               |                                      |
| A 9.              | Team to oversee training of all providers |                               |                                      |
| A a. Neonatologist | Name                   |                               |                                      |
| A b. Pediatric Neurologist | Name                  |                               |                                      |
| A c. Clinical Nurse Specialist | Name                  |                               |                                      |
| D 10.             | Developmental Care Team | OT:                           | PT: Developmental Specialists:       |
| D 11.             | Lactation Support      | Describe hours of service, number of FTE, services provided |                                      |
| D 12.             | Palliative Care        | Do you have a written neonatal-specific palliative care clinical guideline?  
   What are your standards for ensuring staff well-being (debriefing, etc)? |                                      |
| D 13.             | Spiritual Care/Chaplain| Describe availability or hours |                                      |

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Page 2 of 6

Program Initiation Date: ______
Program Review Dates(s): _____/_____/_____/_____/_____/_____/_____
<table>
<thead>
<tr>
<th>Section* (CCS-NL)</th>
<th>Criteria Met (Y/N/NA)</th>
<th>Yes: Describe current practice</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>MEDICAL &amp; DIAGNOSTICS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B-1 Physician Coverage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Physician coverage – Neonatologist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Physician coverage – Neurologist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Physician coverage – Neurophysiologist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Physician coverage – Neuroradiologist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Physician coverage – HRIF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Does every TH infant get a Neuro consultation within the first 12 hours life?</td>
<td>% In-Person vs On-Phone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Does every TH infant get a clinical assessment by a Pediatric Neurologist within 24 hours of birth?</td>
<td>% by 24 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Does your Pediatric Neurologist perform clinical examinations during TH, review neuro-monitoring, review neuro-imaging?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B-2 NEURO-MONITORING</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Are all infants undergoing TH are monitoring continuously with cEEG or aEEG?</td>
<td>% aEEG % cEEG Age at initiation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Do you have cEEG available on-site, during normal work hours?</td>
<td>Describe process to order/activate; average time to initiate after order placed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Are your cEEG recordings reviewed within 24 hours by a neurophysiologist or a child neurologist with neonatal EEG expertise?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Is aEEG used in your NICU?</td>
<td></td>
<td>If used:</td>
<td></td>
</tr>
</tbody>
</table>

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</tr>
</thead>
</table>
|                    |                       | **a) how were your providers trained?** *(See worksheet)*  
|                    |                       | **b) provide example of standardized documentation**  
| **B-3** NEURO-IMAGING |                       |                                |                                      |
| 1.                  | Do you have on-site MRI with DWI capabilities? |                                |                                      |
| 2.                  | Are MRI’s performed on all infants undergoing TH before discharge? | % completed  
|                    |                       | Reason for any variance below 100%  
|                    |                       | % done as outpatient  
| 3.                  | Is sedation used for your MRI’s? | % completed with/without sedation  
| 4.                  | Are your MRI’s reviewed by a neuroradiologist with neonatal expertise? | Describe training  
|                    |                       | Describe plan for training or staff recruitment  
|                      |                       | Use of telemedicine?  
| **B-4** TRANSFER FOR HIGHER LEVEL OF CARE |                       |                                |                                      |
| 1.                  | Do you provide HFV, ECMO, iNO? |                                | Established relationship with referral center?  
| 2.                  | In the last 3 years have you transferred infants for a Higher LOC? | Provide list of patients and reasons for referral for higher LOC  
| **B-5** HIGH RISK INFANT FOLLOW UP |                       |                                |                                      |
| 1.                  | Do all infants have a referral to HRIF upon discharge? |                                |                                      |
| 2.                  | Do all infants have an appointment for HRIF upon discharge? |                                |                                      |

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<th>No: Describe plan for meeting standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Referral to Pediatric Neurologist for infants with: seizures, going home on AED’s, and documented brain injury on MRI</td>
<td></td>
<td>Document % of appointments on DC</td>
<td></td>
</tr>
</tbody>
</table>

**C TRAINING & COMPETENCY**

1. All providers have completed a minimum of 8 hours of training
   
   (Use “Education Documentation” checklist for each member of your team who provides cooling)

2. Annual competency has been documented
   
   List where annual competency records are stored and outline of relevant content from the last 3 years

**D ANCILLARY SERVICES**

See earlier sections

**E OUTREACH**

Do you have culturally-sensitive, family-centered handouts for parents that explain HIE and TH

Are you a referral center for TH patients?

Document education provided and to whom and what dates. Be sure to include OB + General Pediatric Providers who attend deliveries.

Cover topics related to:
- Identification and timely referral
- Risk factors for encephalopathy
- Eligibility criteria for cooling

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Page 5 of 6

Program Initiation Date: ______

Program Review Dates(s): ______/______/______/______/______/______/______/

*If you are a CCS-Paneled NICU in California providing Therapeutic Hypothermia to Infants with HIE these services and practices are required per CCS NL 06-1116*
### Section* (CCS-NL)

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</thead>
<tbody>
<tr>
<td></td>
<td>M&amp;M Review</td>
<td></td>
</tr>
</tbody>
</table>

#### Other activities

<table>
<thead>
<tr>
<th>F QUALITY ASSURANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol to monitor quality of care</td>
</tr>
<tr>
<td>Blood gas screening</td>
</tr>
<tr>
<td>Cooling provided according to center’s policy and criteria</td>
</tr>
<tr>
<td>Assurance that infants get recommended monitoring, imaging, and follow-up</td>
</tr>
<tr>
<td>% monitored</td>
</tr>
<tr>
<td>% imaged</td>
</tr>
<tr>
<td>% follow up with HRIF</td>
</tr>
<tr>
<td>% follow up with Neurology</td>
</tr>
<tr>
<td>Monitor temperature control</td>
</tr>
<tr>
<td>Avg. Time to Target Temp</td>
</tr>
<tr>
<td>Frequency of out of range temps</td>
</tr>
<tr>
<td>Adverse Events</td>
</tr>
<tr>
<td>EX: Bradycardia (requiring treatment)</td>
</tr>
<tr>
<td>Coagulopathy (requiring treatment)</td>
</tr>
<tr>
<td>Pressure Ulcers</td>
</tr>
<tr>
<td>Sub-Cutaneous Fat Necrosis</td>
</tr>
</tbody>
</table>

#### Other parameters

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Program Initiation Date: ____

Program Review Dates(s): _____/_____/_____/_____/_____/_____/____/____/____/

*If you are a CCS-Paneled NICU in California providing Therapeutic Hypothermia to Infants with HIE these services and practices are required per CCS NL 06-1116*
# THERAPEUTIC HYPOTHERMIA EDUCATION* DOCUMENTATION

Name: ___________________________________________________________

Discipline/Role: □ MD □ NNP □ RN □ RT □ OT □ PT □ DEV SPEC □ OTHER

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>EDUCATION OBTAINED FROM</th>
<th>DATE EDUCATION COMPLETED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pathophysiology of HIE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Differential diagnoses of HIE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Mechanism by which TH provides neuroprotection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Early screening and identification of neonates eligible for TH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Application and interpretation of aEEG to detect seizures and background patterns (if using aEEG in your center)</td>
<td></td>
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<tr>
<td>6. Standardized neurologic examination to determine eligibility for TH</td>
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<tr>
<td>7. How to initiate TH using a servo-regulated device and performing temperature monitoring</td>
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<tr>
<td>8. Recognition of clinical seizures</td>
<td></td>
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<tr>
<td>9. Management of non-neurologic complications associated with global hypoxia-ischemia</td>
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</tbody>
</table>

Reviewed by: __________________________________________ Date: ______________________________

*These are the education requirements required for Cooling Centers in California – per the NL 06-1116. Your hospital requirements may differ.
<table>
<thead>
<tr>
<th>Name/Title/Credentials</th>
<th>Type of training</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Device Representative</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Online Course</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Neuro-Monitoring Conference</td>
<td></td>
</tr>
<tr>
<td></td>
<td>aEEG Workshop</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Neonatal or Neurology Fellowship Training</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device Representative</td>
<td></td>
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<tr>
<td></td>
<td>Online Course</td>
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<td>aEEG Workshop</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Neonatal or Neurology Fellowship Training</td>
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</tr>
</tbody>
</table>
QUALITY IMPROVEMENT METRICS
For cooling programs

This is not even close to an exhaustive list but food for thought around the parameters you can monitor in your NICU.

1. Time of first neuro exam
   a. Serial Sarnat examinations completed and documented
2. Time determined eligible for cooling (age in hours)
3. Time passive/active cooling started
4. Time to target core temperature
5. Frequency of out-of-range temperatures
6. Time of initiation of brain monitoring - video-EEG, aEEG, NIRS
7. Time of consultation by Neurologist
   a. Average age at first examination
   b. Document % of appointments on DC
8. Time to parental first holding
9. Time to first enteral feeding
10. Time to first oral feeding
11. Time to first full oral feeding
12. Feeding disposition at DC
13. Imaging completed before DC
   a. Timing of MRI – average Day of Life
   b. % completed
   c. Reason for any variance below 100%
   d. % completed with/without sedation
   e. % done as outpatient

There are many other parameters that you could measure.

- What are your current quality metrics for your cooling program?
- How do you share these with your staff? And how often?
7 Steps to aEEG Interpretation

1. Story – Review History
2. Signal – Confirm good impedance
3. Strength – Assess Background Activity
4. Sleep-Wake Cycling
5. Suspicious Areas/Seizures
6. Symmetry
7. Stability
## 4 Questions to Classify aEEG

<table>
<thead>
<tr>
<th>Question</th>
<th>No</th>
<th>Name of tracing</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is the upper border above 5?</td>
<td>X</td>
<td>= Inactive</td>
<td>Continue to #2</td>
</tr>
<tr>
<td>2. Is the upper border above 10?</td>
<td>X</td>
<td>= Continuous low voltage</td>
<td>Continue to #3</td>
</tr>
<tr>
<td>3. Is the lower border above 5?</td>
<td></td>
<td>= Continuous normal voltage</td>
<td>X</td>
</tr>
<tr>
<td>4. Is there variability of the lower border?</td>
<td></td>
<td>= Discontinuous normal voltage</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>= Burst Suppression</td>
<td></td>
</tr>
</tbody>
</table>

(c) Syanpse Care Solutions 2018
<table>
<thead>
<tr>
<th>Pattern Description</th>
<th>Waveform Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous normal voltage pattern, C</td>
<td>Upper margin &gt;10-25μV, Lower margin &gt;(5-)7-10μV</td>
</tr>
<tr>
<td>Discontinuous pattern, DC</td>
<td>Upper margin &gt;10-25μV, Lower margin &lt;5μV</td>
</tr>
<tr>
<td>Burst suppression pattern, BS</td>
<td>Lower margin 0-1(-2)μV, Bursts &gt;25μV, BS- &lt;100 bursts/hour, BS+ &gt;100 bursts/hour</td>
</tr>
<tr>
<td>Low voltage, LV</td>
<td>Lower margin at or &lt;5μV, Upper margin &lt;10μV</td>
</tr>
<tr>
<td>Inactive, flat trace, FT</td>
<td>Upper and lower margin continuously &lt;5μV</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Graph Description</td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>Continuous Normal Voltage</td>
<td>TERM</td>
</tr>
<tr>
<td>Discontinuous Normal Voltage</td>
<td>PRETERM OR SICK TERM</td>
</tr>
<tr>
<td>Burst Suppression</td>
<td>SICK TERM OR EXTREMELY PRETERM</td>
</tr>
<tr>
<td>Continuous Low Voltage</td>
<td>VERY SICK TERM OR PRETERM</td>
</tr>
<tr>
<td>Inactive Flat Isoelectric</td>
<td>VERY, VERY SICK TERM OR PRETERM</td>
</tr>
</tbody>
</table>
## aEEG Classification Framework

<table>
<thead>
<tr>
<th>Pattern Description (Hellstrom Westas &amp; Toet)</th>
<th>Voltage Based (Ali Naqeeb)</th>
<th>Lower Margin (in μV)</th>
<th>Upper Margin (in μV)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Continuous Normal Voltage</strong></td>
<td>Normal (Type 1)</td>
<td>↑5</td>
<td>↑10</td>
</tr>
<tr>
<td><strong>Discontinuous Normal Voltage</strong></td>
<td>Moderately Abnormal (Type 2)</td>
<td>↓5</td>
<td>↑10</td>
</tr>
<tr>
<td><strong>Burst Suppression</strong></td>
<td>Severely Abnormal (Type 3)</td>
<td>↓5</td>
<td>↑25</td>
</tr>
<tr>
<td><strong>Continuous Low Voltage</strong></td>
<td>Severely Abnormal (Type 3)</td>
<td>↓5</td>
<td>↓10</td>
</tr>
<tr>
<td><strong>Inactive</strong></td>
<td>Severely Abnormal (Type 3)</td>
<td>↓5</td>
<td>↓5</td>
</tr>
</tbody>
</table>

(c) Syanpse Care Solutions 2018
FREE RESOURCES

- **E-Book:** 7 Steps to Read Any aEEG
- **Monthly FREE Q&A Calls with Kathi Randall (and special guests)**
  - 15 minute lecture
  - 15 minutes discussion

**Online aEEG Mastery Course**

- Online, On Demand, Nursing CEU available
- For Individuals and Teams
- Group Discounts Available
- **Register at:** Get more information at: [courses.synapsecare.com](http://courses.synapsecare.com)
SECTION 3

Additional Online Resources

COURSES + CALCULATORS + VIDEOS
Cooling Courses & aEEG Course  
www.courses.synapsecare.com

NeuroNICU Nurse Training Conference:  
http://synapsecare.com

HIE Calculator (FL) –  
https://www.peds.ufl.edu/apps/hiecalculator/index.asp

CPCQCC Toolkit – HIE/COOLING:  

Neonatal Encephalopathy Videos (Teaching)  
https://people.stanford.edu/wusthoff/

MRI Online Textbook – HIE:  
http://www.mrineonatalbrain.com/ch04-06.php#cont-4

Smart Phone App: NeoCool - NeuroExam Tool  
Available for Android and iOS Phones
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If you need an education plan for your cooling team, save time and money, and get your entire team trained quickly by enrolling in this online course.

COURSE OUTLINE & FACULTY

BACKGROUND & ASSESSMENT

• Neonatal Asphyxia & Improving Outcomes – Dr. Lina Chalak, Neonatologist (UT Southwestern/TX Children’s/Parkland Hospital, Dallas, TX)
• Eligibility Criteria for Cooling & Bedside Exam – Rachelle Sey, CNS (Sharp Mary Birch Hospital, San Diego)

MONITORING & IMAGING

• Brain Cooling & NIRS Monitoring – Dr. Valerie Chock, Neonatologist (Lucile Packard Children’s Hospital, Stanford University)
• Neonatal EEG and aEEG Monitoring – Dr. Courtney Wusthoff, Neurologist (Lucile Packard Children’s Hospital, Stanford University)
• Neuroimaging infants with HIE - Dr. Courtney Wusthoff, Neurologist (Lucile Packard Children’s Hospital, Stanford University)
• The Use of aEEG for Infants with HIE – Dr. Gabriel Variane, Neonatologist (Grupo Santa Joana, Sao Paolo, Brazil)
• *Best Practices for Sedation-Free MRI – Deb Marks, NNP and Christina Meehan, RN (Brigham & Women’s Hospital, Boston, MA)

CARING PRACTICES DURING COOLING

• *Bedside Pearls for Caring for Infants with HIE & Undergoing Cooling – Sonia Bonifacio, Neonatologist (Lucile Packard Children’s Hospital, Stanford University)
• Skin Issues Related to Therapeutic Hypothermia and Cerebral Monitoring – Carolyn Lund, CNS (Benioff Children’s Hospital, Oakland, CA)
• Implementing a Care Map for Infants with HIE – Diane Wilson, NNP (Hospital for Sick Kids, Toronto, Canada)
• Diagnosis and Management of Neonatal Seizures - Dr. Courtney Wusthoff, Neurologist (Lucile Packard Children's Hospital, Stanford University)
• *Parent Perspectives on HIE – Lisa Miller (New York)
• *Feeding Controversies - Dr. Michael Weiss, Shands, FL

BACKGROUND & ASSESSMENT

• The Role of Neonatal Therapy and HIE – Kelly Andrasik, MOT (Lucile Packard Children’s Hospital)
• Unmet Parent Expectations, Communication Challenges and Traumatic and Healing Experiences Surrounding Cooling – Dr. Alexa Craig, Neurologist (Maine Medical Center)
• Quality Metrics for a Therapeutic Hypothermia Program - Carolyn Lund, CNS (Benioff Children’s Hospital, Oakland, CA)
• Implementation Science Methodology to Improve Consistency & Optimize Treatment for Newborns with HIE – Joan Smith, PhD, NNP (St. Louis Children’s Hospital, St. Louis, MO)
• *Beyond the NICU – Long Term Follow up of Infants with HIE – Dr. Linda de Vries, Neonatologist (Utrecht University NICU, Netherlands, Holland)
COURSE OBJECTIVES:

BACKGROUND & ASSESSMENT
- Describe the two-phase pathophysiology of HIE and how therapeutic hypothermia impacts the injury
- List at least two other neonatal conditions that might mimic HIE during the first day of life
- Discuss the evidence for the current cooling therapy and two ongoing research projects to direct future practice
- List the eligibility criteria for therapeutic hypothermia in your NICU in terms of: infant characteristics, timing of intervention and contraindications
- Name the tool your NICU uses to assess infants with HIE; and list at least two abnormal exam findings which might qualify an infant for therapeutic hypothermia.

MONITORING & IMAGING
- Identify two expected aEEG patterns during HIE and describe the expected evolution during the first days of life
- Describe the significance of high and low cerebral NIRS values during therapeutic hypothermia
- Discuss the rationale for the type and timing of neuro-imaging for infants with HIE
- Describe the implementation process for non-sedated MRI

CARING PRACTICES DURING COOLING
- Discuss the risk for, and management of, at least one potential clinical complication encountered during the three phases of therapeutic hypothermia: induction, maintenance and rewarming.
- Recognize the clinical presentation of neonatal seizures and outline the traditional pharmacologic management
- Describe one or more benefits of using a servo-controlled temperature regulatory device
- Discuss the pros and cons of: sedation, feeding, and infant holding during cooling
- Discuss the role of OT, PT, and developmental specialists for infants with HIE - during cooling and beyond
- List three strategies to improve communication with parents whose infants are undergoing cooling

FOLLOW UP & QUALITY
- Describe at least one common feeding-related concern seen in infants with HIE
- List at least three quality care metrics which could be measured for your hypothermia program

CE CREDIT & REFUND POLICY
This course is pending approval by the California Board of Registered Nurses, Provider Number 15417, for at least 9.6 contact hours.
* Due to the digital nature of this course, there are no refunds.
WEBINAR: IMPLEMENTING NEW CA COOLING REGS

ALL YOU NEED TO KNOW TO GET STARTED
TOP TAKEAWAYS

1.

2.

3.
BONUS WEBINAR NOTES

TOP TAKEAWAYS

1.

2.

3.
ADDITIONAL RESOURCES FOR CALIFORNIA COOLING PROGRAMS

WEBINAR. CCS LETTER. CPQCC TOOLKIT

BABY BRAINS ARE OUR BUSINESS
Consulting, Courses & Conferences
DATE: November 17, 2016

Numbered Letter: 06-1116
Index: Program Administration

TO: CALIFORNIA CHILDREN’S SERVICES (CCS) PROGRAM COUNTY ADMINISTRATORS, MEDICAL CONSULTANTS, AND STATE SYSTEMS OF CARE DIVISION OFFICE STAFF

SUBJECT: PROGRAM REQUIREMENTS FOR PROVIDING NEONATAL THERAPEUTIC HYPOTHERMIA

I. PURPOSE

This Numbered Letter (N.L.) describes minimum requirements for CCS Program-approved Neonatal Intensive Care Units (NICUs) to provide therapeutic hypothermia services to neonates.

II. BACKGROUND

Neonatal encephalopathy is a condition that often results in adverse outcomes including death, cerebral palsy, developmental delay, and seizure disorder. Therapeutic hypothermia (TH) has become the standard in treatment of neonatal encephalopathy because it has been demonstrated to have the capability to prevent death and major disability during the neonatal period.

III. POLICY

A. Program

1. Neonatal Intensive Care Units providing therapeutic hypothermia (TH) shall be CCS Program-licensed and meet the American Academy of Pediatrics criteria for Level III care.

2. TH shall be conducted using a servo-regulated device.

3. Hospital birth rate and/or catchment area birth data shall support, on average, at least 6 treated patients per year.
4. Centers that provide TH to <12 patients/year shall have a formalized relationship with a regional center of expertise to ensure maintenance of education and competencies.

5. Each TH program shall be overseen by a neonatologist working in conjunction with a pediatric neurologist and clinical nurse specialist to:
   a. Develop clinical guidelines for TH patient selection and management, as well as for neuroimaging, and neuromonitoring procedures;
   b. Review adverse events, perform quality assurance, and conduct quality improvement initiatives as warranted by local data;
   c. Oversee training of all providers who participate in providing TH.

B. Medical/Diagnostic

1. Physician coverage
   a. A board-eligible/board-certified neonatologist shall oversee patient care for infants undergoing TH and provide 24-hour coverage in accordance with CCS Program standards.
   b. A child neurologist shall be accessible at all times for consultation, at minimum via telephone or telemedicine.
      (1) Every infant undergoing TH shall have a consultation with a pediatric neurologist within the first 12 hours of life, at minimum via phone. Initial clinical assessment would ideally be performed in the first 24 hours of life.
      (2) During the cooling process, the neurologist's role will encompass, at minimum, clinical assessment and regular review of neuromonitoring and neuroimaging studies.

2. Neuromonitoring
   a. All infants undergoing TH shall be monitored continuously during hypothermia and rewarming using conventional video EEG (cEEG) or amplitude-integrated EEG (aEEG)
   b. cEEG shall be available on-site, at minimum, daily during regular work hours.
c. cEEG shall be reviewed by a neurophysiologist or child neurologist with experience in neonatal EEG and interpreted within 24 hours.

d. aEEG monitoring shall be reviewed on an ongoing basis at the bedside, with interpretation documented in the medical record by a provider with experience in neonatal aEEG.

e. Competency in aEEG interpretation may be obtained through:

   (1) training from a device representative and supplemented with an online course;

   (2) attendance at neuromonitoring conferences and workshops;

   (3) experience obtained through neonatology fellowship training.

3. Neuroimaging

   a. Centers that perform TH shall have the equipment and staffing available on-site to perform magnetic resonance imaging (MRI) with diffusion weighted imaging in a neonate with and without sedation.

   b. MRI shall be performed prior to hospital discharge on all infants undergoing TH.

   c. MRI shall be interpreted by a neuroradiologist with experience in neonatal brain imaging.

   d. Centers without a neuroradiologist on staff may partner through telemedicine support to ensure that adequate imaging sequences are obtained, and for interpretation purposes.

4. Transfer to higher level of care (LOC)

   a. TH programs that do not have the capacity to administer high frequency ventilation, inhaled nitric oxide, and/or extracorporeal membrane oxygenation shall develop guidelines for transfer to a higher LOC in conjunction with a regional center that can provide these treatments, including inhaled nitric oxide and TH during transport.

   b. In addition to services outlined above, transfer to a higher LOC shall occur for the following circumstances:

      (1) To facilitate enhanced neurological care;
(2) Need for ancillary testing or specialty input not available at the local center;

(3) Ethics consultation: If an ethics consultation has been requested and an on-site neurologist is not available, recommend transfer to higher LOC for complete evaluation;

(4) At the discretion of the clinical care team, including neonatology and pediatric neurology.

5. High Risk Infant Follow Up (HRIF)
   a. All patients receiving TH shall be referred to a CCS Program-approved HRIF program at the time of discharge.
   b. Infants diagnosed with seizures, discharged on anti-seizure medication, or with brain injury on MRI shall be referred to a pediatric neurologist upon discharge.

C. Training/Competency

1. Prior to establishing a TH program, nurses, nurse practitioners, and physicians shall undergo at least 8 hours of training to gain adequate background knowledge in the care of TH patients in the following areas:
   a. Pathophysiology of hypoxic-ischemic encephalopathy (HIE) and differential diagnosis of neonatal encephalopathy;
   b. Mechanisms by which TH provides neuroprotection;
   c. Early screening and identification of neonates eligible for TH;
   d. Application and interpretation aEEG to detect seizures and background patterns (for sites where aEEG will be used);
   e. Standardized neurologic examination to determine eligibility for TH;
   f. How to initiate TH with a servo-regulated device and perform temperature monitoring during induction, maintenance, and rewarming phases of treatment;
   g. Recognition of clinical seizures;
h. Management of non-neurologic complications associated with global hypoxia-ischemia, including multi-organ failure, glucose homeostasis, and adverse events associated with TH.

6. A mechanism shall be in place to review staff competencies on an annual basis.

B. Ancillary support

1. In addition to the ancillary supports required for community and regional NICUs, the following ancillary supports are required:

   b. Developmental care team: Occupational therapy, physical therapy, and developmental care plans should be routinely included in the care plan of infants receiving TH;

   c. Lactation support: Each center must have equipment and resources to support pumping, breast milk storage, and specialist consultation for issues of milk supply, latch and swallow, and supply maintenance;

   d. Palliative care: Each center shall have a neonatal-specific palliative care clinical guideline that includes:

      (1) Training and continuing education for staff specific to palliative care, including attention to staff well-being through debriefings or other activities;

      (2) Spiritual care/chaplain resources available for staff and families.

C. Outreach

1. Centers providing TH shall provide family-centered care by developing culturally sensitive handouts for parents to explain HIE and TH, and by encouraging parents to participate in the care of their infants.

2. Centers providing TH are responsible for offering outreach to community hospitals for the purpose of:

   b. Providing education regarding the awareness and timely identification of infants at risk for encephalopathy;

   c. Educating providers regarding the eligibility criteria for TH, including obstetric and general pediatric care providers;
d. Conducting outreach for the purposes of morbidity and mortality review.

D. Quality improvement/Quality assurance

1. Centers providing TH shall have a written protocol and system in place to monitor quality of care and pre-discharge outcomes and to guide quality improvement activities, including:

   a. Mechanism to screen for infants at risk for HIE through blood gas and/or clinical criteria (see California Perinatal Quality Care Collaborative toolkit: “Neonatal Therapeutic Hypothermia”);

   b. Assurance that cooled infants have met center’s eligibility criteria, receive recommended neuromonitoring and neuroimaging, and are referred for appropriate follow-up;

   c. Temperature control, including time to target temperature and frequency of temperatures out of range once cooled;

   d. Adverse events including but not limited to: bradycardic arrest associated with overcooling, and pressure ulcers acquired during cooling.

2. Data shall be collected and reviewed, at minimum, on an annual basis.

For questions regarding this N.L., please contact Joseph Schulman, MD MS at 916- 327-2487 or via e-mail at Joseph.Schulman@dhcs.ca.gov. Thank you for your services to California’s children.

Sincerely,

ORIGINAL SIGNED BY ROBERT DIMAND

Robert Dimand, M.D.
Chief Medical Officer
Children’s Medical Services
MORE RESOURCES

CPQCC
HIE
TOOLKIT

GUIDELINES. QI FORMS. PARENT EDUCATION

BABY BRAINS ARE OUR BUSINESS
Consulting, Courses & Conferences
California Perinatal Quality Care Collaborative

Early Screening and Identification of Candidates for Neonatal Therapeutic Hypothermia Toolkit

Released February 2015

Priya Jegatheesan, MD, Anna Morgan, MD, Thomas Shimotake, MD, Dongli Song, MD, PhD and Krisa Van Meurs, MD on behalf of the Perinatal Quality Improvement Panel (PQIP), California Perinatal Quality Care Collaborative (CPQCC)
Recommended Guidelines and Algorithms

Screening Algorithm and Criteria for Consultation with Cooling Center

Given that the therapeutic window for cooling is within the first 6 hours of life, prompt recognition of candidates for therapeutic hypothermia is crucial for its success. Therefore, any infant delivered with perinatal depression, or in the setting of an acute perinatal event, should be evaluated expeditiously for signs of hypoxic ischemic encephalopathy (HIE) after initial resuscitation and stabilization.

Although specific criteria for initiating therapeutic hypothermia vary between cooling centers, in general they are derived from entry criteria used in published multi-center randomized control trials evaluating hypothermia as a therapeutic intervention for term neonates with moderate/severe HIE.\(^{12-18}\) In order to facilitate prompt recognition and referral of these infants, we have devised a standard algorithm for identification and evaluation of potential cooling candidates born at outside facilities. Our intent is to cast a wide net, capturing as many infants as possible who may benefit from cooling. Therefore, the screening criteria, as outlined in Appendix A, is generally more liberal than individual centers’ actual cooling criteria. Similar workflows have been successfully implemented in several northern California centers including UCSF Benioff Children’s Hospital Oakland, Kaiser Permanente, and Santa Clara Valley Medical Center, all of which participated in devising the criteria presented here.

As outlined in Appendix A, to be considered for closer evaluation by a regional cooling center, neonates must be:

- \( \geq 35\) weeks gestational age and \( \leq 6\) hours old
- Any one of the following must also be present:
  1. History of acute perinatal event
  2. Apgar \( \leq 6\) at 10 minutes
  3. Continued need for positive pressure ventilation (PPV) for 10 minutes or history of CPR
  4. Venous or arterial cord gas or baby blood gas with pH \( \leq 7\) or BE \( \leq -10\)

If any of the first three criteria are met, an attempt should be made to collect an umbilical cord blood gas as well as an infant blood gas at less than 1 hour of age. A targeted neurologic exam should also be performed once the infant has been stabilized (Appendix B is an example of a standardized neurologic exam checklist.) The baby should be closely monitored for seizures.

According to the screening algorithm, the practitioner is then prompted to call the nearest cooling center to discuss the case and the potential need to transfer care for further evaluation and cooling. While most cooling criteria allow for identification and initiation of cooling therapy within 6 hours of birth, ideally the initial call to a regional cooling center is made within 2 hours of birth for all infants. In fact, in cases where there is clear evidence of HIE particularly when the infant has a severely abnormal neurologic exam or is critically ill, the call should be made within 1 hour of birth.

This screening algorithm (Appendix A), with its associated focused neurological exam, can be printed, laminated, and posted in the delivery room and/or at physician workstations for quick
Throughout this phase of evaluation, the baby should continue to receive standard ongoing intensive care and referring hospitals should be prepared to provide early, yet safe initiation of passive cooling, once it is determined that the infant is a candidate for cooling, as described in Appendix C. This entails having the appropriate equipment, as well as properly trained staff, to monitor these infants. The radiant warmer should be turned off, with the infant remaining uncovered. The core temperature should be measured at least every 15 minutes by whatever means is considered safe and routine in the birth hospital. Ideally, continuous rectal temperature monitoring is initiated. If rectal monitoring is not available, then axillary temperatures should be measured. The goal core temperature is 33.5°C (equivalent to approximately 32.5°C axillary). Of note, infants that are cooled to this temperature range can become relatively bradycardic with resting heart rates in the 80-100 bpm range. This is to be expected, and does not cause or worsen hemodynamic instability. However, if the core temperature drops below 33°C (32°C axillary), the heart rate may fall to dangerously low levels. It is recommended to turn the warmer back on its lowest setting or cover the patient loosely with a blanket, and continue to monitor core temperatures closely until the target temperature and baseline heart rates are restored. Just as overcooling can place the infant at significant risk, inadvertent over-heating a baby with HIE may also worsen brain injury. Therefore, continued vigilance by monitoring and maintaining core temperature in target range is of utmost importance.

Ongoing support for potential cooling candidates may also include measures to correct metabolic acidosis, appropriate respiratory support and vigilant surveillance and treatment of hypotension. Infants are often made NPO and started on intravenous fluids initially. Hypoglycemia may exacerbate hypoxic brain injury in these neonates. Therefore, glucose levels should be checked early and monitored frequently to maintain blood sugars >50mg/dl. In any infant accepted for evaluation at a cooling center, placement of umbilical catheters is helpful prior to transport, but may depend upon the comfort level and experience of the providers at the referring center. This can be discussed with the cooling center, but peripheral IV access should be obtained at a minimum. Pre- and postductal saturation measurements may also be helpful to identify possible pulmonary hypertension. Initial laboratory evaluation should include CBC, coagulation panel, Chem-10, LFTs, lactate, as well as blood cultures and repeated blood gases, as warranted.

Once a potential cooling candidate has been identified through the screening algorithm, it is vital that the nearest affiliated hypothermia/cooling center be notified expeditiously. Though most protocols provide for a 6 hour window before initiation of cooling therapy, ideally the call should be by no later than 2 hours of age. Infants with clear signs of encephalopathy (severely abnormal neurologic exam) and who are critically ill should be discussed with the cooling center as soon as possible after birth. As noted previously, the screening criteria in this toolkit are designed to be purposely broad so as to capture all infants who may be at risk for developing significant HIE. As a result, not all infants that meet screening criteria for consultation with a cooling center will ultimately qualify for therapeutic hypothermia. In this setting, the cooling center’s role is to determine whether transfer for continued evaluation and possible therapeutic hypothermia is warranted, as well as to advise the referring hospital on ongoing care. If the infant has undergone passive cooling and is subsequently deemed not eligible or not requiring therapeutic hypothermia, careful re-warming per direction of the cooling center or by specific guidelines should ensue (Appendix E). Because these are often infants with complications at birth, they may be at risk for other co-morbidities which might require specialized intensive care, regardless of their cooling status.
Ultimately, the cooling center plays a central role in triaging potential cooling candidates and advising the referring hospital on appropriate management. The ability to do so, in turn, hinges on prompt identification and evaluation of these infants at the birth hospital, as well as streamlined communication between the birth hospital and the cooling center (Appendix J). It is vital that cooling centers take the lead in establishing educational outreach programs to ensure optimal identification and management of this vulnerable patient population.

As HIE often occurs unexpectedly, it places families in a stressful situation where decisions are being made quickly about the care of their child. To achieve the best possible outcome for the infant, therapeutic hypothermia needs to be initiated within 6 hours of birth. This requires the healthcare providers (at both the birthing hospital and the cooling center) and the parents to develop a rapport quickly in order to work in partnership to provide the best possible care for their child. Providing adequate information about HIE and hypothermia therapy is important because it helps them cope with the fear and uncertainty of their situation, gives them a sense of involvement and control, and re-affirms their role as parents (Appendix F).
Appendix A

Screening Criteria for Evaluation of Risk for Neonatal Encephalopathy (NE)

Goal timeline

<table>
<thead>
<tr>
<th>Birth</th>
<th>≥35 weeks ≤6 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 10 mins</td>
<td>Apgar ≤6 at 10 min, History of acute perinatal event, Continued PPV at 10 min or CPR, Cord blood gas pH ≤7 or BE ≤-10</td>
</tr>
<tr>
<td>10 - 60 mins</td>
<td>Request cord blood gas, Obtain blood gas at ≤1 hour of age, Perform targeted neurologic exam using chart below, Observe for seizures</td>
</tr>
<tr>
<td>60 - 120 mins</td>
<td>Call cooling center at (___) ___ - ____ to discuss the need for transfer and cooling</td>
</tr>
</tbody>
</table>

Level of encephalopathy

<table>
<thead>
<tr>
<th>Level of consciousness</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irritable / hyperalert</td>
<td>Lethargic / obtunded</td>
<td>Stupor / coma</td>
<td></td>
</tr>
<tr>
<td>Normal / increased</td>
<td>Decreased</td>
<td>No activity</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>Distal flexion / Complete extension</td>
<td>Decerebrate</td>
<td></td>
</tr>
<tr>
<td>Normal / increased</td>
<td>Hypotonic</td>
<td>Flaccid</td>
<td></td>
</tr>
<tr>
<td>Primitive reflexes</td>
<td>Normal</td>
<td>Weak</td>
<td>Absent</td>
</tr>
<tr>
<td>Suck</td>
<td>Normal</td>
<td>Incomplete</td>
<td>Absent</td>
</tr>
<tr>
<td>Moro</td>
<td>Normal</td>
<td>Incomplete</td>
<td>Absent</td>
</tr>
<tr>
<td>Deep tendon reflexes</td>
<td>Mildly brisk</td>
<td>Brisk</td>
<td>Suppressed</td>
</tr>
<tr>
<td>Autonomic system</td>
<td>Normal</td>
<td>Constricted</td>
<td>Deviated, dilated, non-reactive</td>
</tr>
<tr>
<td>Pupils</td>
<td>Increased</td>
<td>Bradycardic</td>
<td>Variable</td>
</tr>
<tr>
<td>Heart rate</td>
<td>None</td>
<td>Common</td>
<td>Common</td>
</tr>
</tbody>
</table>
# Appendix B

## Standardized Neurologic Exam Checklist


<table>
<thead>
<tr>
<th>Patient Name______________________________</th>
<th>Date of examination________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date/time of birth________/________</td>
<td>Time of examination________________________</td>
</tr>
<tr>
<td>Intubated ☐ Yes ☐ No</td>
<td>Medication: ____________________</td>
</tr>
<tr>
<td>Temperature _____ºC</td>
<td>Temperatures: ____________________</td>
</tr>
<tr>
<td>Source: ______ (e.g., axillary/rectal/skin)</td>
<td>Source: ____________________</td>
</tr>
</tbody>
</table>

**MENTAL STATUS:**

1. **Does the baby cry?**
   - Vocalization ☐ Normal ☐ High-pitched, irritable ☐ Weak ☐ No cry

2. **Does the baby open his/her eyes?**
   - Eye opening ☐ Spontaneous, sustained ☐ Brief or to stimulus ☐ No eye opening

3. **Does the baby move?**
   - Motor response ☐ Yes, spontaneous, smooth, coordinated ☐ Yes, spontaneous but jittery
   - ☐ Yes, to pain only ☐ No movement

**TONE:** *(i.e., Resistance to passive movement)*

- Truncal determine
  - ☐ Normal ☐ Decreased ☐ Increased ☐ Cannot
- Extremities determine
  - ☐ Normal ☐ Decreased ☐ Increased ☐ Cannot

**PRIMITIVE REFLEXES:**

- Palmar grasp
  - ☐ Present ☐ Weak ☐ Absent ☐ Cannot determine
- Moro
  - ☐ Present ☐ Weak ☐ Absent ☐ Cannot determine
- Suck
  - ☐ Present ☐ Weak ☐ Absent ☐ Cannot determine

**OTHER:**

**SUMMARY:**

☐ **Normal** – consolable, active, normal exam

☐ **Abnormal hyperalert** - jittery, irritable, agitated

☐ **Abnormal mildly depressed** – decreased or no eye opening, weak cry, movements only with stimulation, depressed primitive reflexes
Appendix C

Management of Screened Neonates Who Qualify for Possible Cooling

1. Identify patients to discuss with regional cooling center within 1 hour of birth.
   a. After initial resuscitation and stabilization, perform screening evaluation (Appendix A).
   b. If screening criteria met, call neonatologist at regional cooling center.
   c. Discuss if patient is appropriate to remain for observation vs. transport for cooling.
   d. If determined to be a candidate for cooling by regional cooling center, begin passive cooling (see also Appendix D)

2. Turn down/off external heat sources and avoid hyperthermia
   a. Document time and do not actively cool patients. (See Appendix D).

3. Monitor core (rectal) temperature closely
   a. Target rectal temp = 33-34°C (91.4 – 93.2°F) or Axillary temp = 32-33°C (89.6 – 91.4).
   b. Check temp continuously/frequently (q15 min). Complete flow sheet (Appendix H).
   c. Core temp may still fall <33.5°C with passive cooling. Be prepared to respond (Appendix D).

4. Secure vascular access - Before peripheral vasoconstriction occurs with cooling.
   a. Umbilical venous and arterial access, if possible.
   b. Peripheral IV at a minimum.

5. Maintain adequate sedation - Keep comfortable/minimize cold stress and avoid shivering during passive cooling.
   a. e.g., Morphine IV – consider prn dosing or continuous infusions as indicated in discussion with cooling center.

6. Treat only clinical seizures – No prophylactic antiepileptic treatments.
   a. Lorazepam (Ativan): 0.1mg/kg/dose IV, repeat once prn for suspected seizures.
   b. Phenobarbital: 20mg/kg IV load, for obvious clinical seizures.

7. Expect these physiologic states in cooled infants
   a. Expect low baseline heart rates (80-100bpm) as patient approaches target temp.
   b. Manage blood pressure and oxygenation as usual. Maintain normal values (see #10).
   c. Consider volume bolus (e.g., normal saline) if perfusion compromised.

8. Monitor electrolytes closely - maintain normal ranges.
   a. Fluctuations often seen in Ca, K, Mg levels with cooling.
9. **Avoid hypoglycemia** - maintain within high normal ranges.
   a. Maintain *Glucose* levels > 50mg/dl.

10. Avoid iatrogenic **hyperventilation** and **hyperoxygenation**.
    a. Target $pCO2= 40-50$ (patients may have compensatory hyperventilation).
    b. Target $PaO2 = 60-100mmHg$ and keep oxygen saturations $= 94-98\%$

11. Send **Blood cultures** and consider **IV antibiotics as indicated**

12. Send **other baseline labs** if indicated, but don’t delay transport for routine labs.
    a. CBC, differential and platelets
    b. Coagulation panel (INR, PT/PTT), LFT, BUN/Cr.
Appendix D

Guidelines for Passive Cooling

1. Document Regional Cooling Center contacted and decision made to initiate passive cooling for those determined to be a candidate for cooling.

2. Turn radiant warmer off and leave infant uncovered, except diapers.

3. Monitor core/rectal temperature continuously (if equipped) or every 15 minutes using a lubricated digital thermometer carefully inserted 2 cm into rectum. If core temperature monitoring cannot be done safely or is not available, monitor axillary temperatures every 15 minutes. Record temperatures on flow sheet (see Appendix H).

4. Allow temperature to fall to target temperature ranges:
   1. Target rectal temperature is 33-34°C or 91.4-93.2°F.
   2. Target axillary temperature is 32-33°C or 89.6-91.4°F.

5. Avoid overcooling. When the rectal temp reaches 33 °C (91.4 °F) or axillary temp 32 °C (89.6 °F), turn warmer back on to lowest setting or covering patient with clear plastic (avoid face).

6. If rectal temp continues to fall quickly or remains < 33 °C (91.4 °F) or axillary temp < 32 °C (89.6 °F), increase warmer setting. Recheck temperature until recovered.

7. Avoid overheating. Minimize big changes in heater settings that may result in overcorrections.

8. Monitor vital signs, electrolytes and glucose levels closely.

9. If administering respiratory support, avoid hyperoxia and iatrogenic hyperventilation.

10. Keep patient comfortable and adequately sedated (i.e., avoid shivering).
Appendix E

Management of Screened Neonates Who Do Not Qualify for Cooling

Not all neonates who meet screening criteria will require or qualify for cooling therapy. However, they may still have significant risks factors that warrant special consideration. These risks may range from mild acidosis to multi-organ dysfunction. In addition, initial signs of neonatal encephalopathy may be subtle and neurologic symptoms may evolve over time. In some cases, passive cooling may already have been initiated. Patients without clinical evidence of perinatal brain injury should be rewarmed only after a thorough evaluation and consultation (phone/video) with a neonatologist at a regional cooling center. Levels of concern and need for observation or other interventions/therapies may be appropriate depending upon the clinical presentation.

1. Maintain communication with regional cooling center
   a. Discuss management and plan if significant clinical changes develop.

2. If heat sources were removed/cooling was initiated, slowly begin rewarming
   a. Document time of lowest temperature and source (e.g., axillary vs. rectal).
   b. Rewarm with target rate of approximately 0.5 °C/hour. Avoid overheating.

3. Monitor temperature periodically
   a. Target rectal/core temp = 36.5°C (97.7°F) or axillary/skin temp = 36.0°C (96.8°F).
   b. Check temperature periodically (e.g., hourly for first 6 hours).

4. Check glucose and electrolyte levels.
   a. Fluctuations may be seen - check Glucose levels. Avoid hypoglycemia
   b. Consider maintaining higher normal target glucose levels (e.g., >50mg/dl)
   c. Consider checking Ca, K, Mg levels. Maintain within normal ranges.

5. Obtain follow-up blood gases to confirm acidosis resolving
   a. If acidosis persists, work-up other causes or discuss with neonatologist.

6. Repeat neurologic examination (see appendix B)
   a. Document initial neurologic exam.
   b. Repeat neurologic exam (e.g., after 1-3 hours) if clinically indicated.
   c. Document neurologic exam at time of discharge.

7. If initial acidosis severe, consider delaying enteral feeds (NPO) until improved
   a. Depends upon severity of clinical presentation. Discuss with neonatologist.
   b. May require initiation of maintenance IVF fluids.

8. Avoid iatrogenic hyperventilation and hyperoxygenation
   a. Normal pCO2 levels (35-45 mmHg) – compensatory hyperventilation may be seen.
   b. Normal PaO2 levels (60-100 mmHg) and oxygen saturations (<94-98%).

9. Consider ordering baseline labs:
   a. CBC, platelets and Blood cultures.
   b. Start antibiotics if appropriate.
Hypothermia Treatment for Hypoxic Ischemic Encephalopathy

*Information for Parents*

**Terminology**

Hypoxic = not enough oxygen  
Ischemic = not enough blood flow  
Encephalopathy = brain injury  
Hypothermia = cooling

**Introduction**

Your baby might have Hypoxic Ischemic Encephalopathy (HIE). This means the baby is sick because the brain may not have gotten enough oxygen or blood flow for a period of time. There could be many reasons why this has happened. Your baby’s doctor will talk with you about what those reasons might be.

A lack of oxygen before and during birth can injure cells in a newborn baby’s brain. How long the brain was without oxygen can impact how serious the problems will be. The damage caused by the lack of oxygen can continue for some time after birth.

**What can be done to treat HIE?**

One way to reduce this damage is to cool the baby for hours to days. For babies with HIE, research has shown that if the brain is cooled just a few degrees below normal body temperature soon after birth, there may be less brain damage. Your baby will be placed on a cooling blanket (hypothermia blanket) for up to three days. After this time, your baby will be slowly re-warmed to normal body temperature.
How will my baby be monitored during the cooling treatment?
While caring for your baby, we will monitor your baby’s heart rate, breathing patterns and temperature. We will also be checking your baby’s brain activity with a cerebral function monitor (CFM). Three tiny probes are placed just under the skin of your baby’s scalp. These probes are connected to the CFM and will help show us if there are any changes in brain activity. Another way we will look at brain activity is with an electroencephalogram (EEG) and a video camera. Blood tests will also be sent to evaluate other aspects of your baby’s health such as infections or metabolic problems.

Does the cooling blanket affect any other parts of the body besides the brain?
It is normal for your baby to have a slower heart rate and breathing rate during the cooling treatment. It is also normal for your baby to be quiet and sleepy.

How will my baby be kept comfortable while on the cooling blanket?
We will be giving medicines to help your baby rest comfortably and will be monitoring your baby closely for any signs of discomfort.

What can I do to help my baby during the treatment?
You are welcome to visit your baby anytime in the Intensive Care Nursery (ICN) according to the ICN guidelines. For the first few days, it is important that your baby rests. Your baby’s nurse can show you ways to participate in your baby’s care.

How will my baby receive nutrition during the cooling treatment?
Your baby will be getting nutrition through intravenous (IV) therapy. After cooling, and when your baby is ready to eat, breast milk or formula will be given. For breastfeeding mothers, please pump and store your milk. We will provide accommodations for you to do this and assist you with using the breast pump.

We realize this is a difficult time for you and your family. The stress of having a baby in the ICN, along with seeing unfamiliar machines and procedures, might be frightening. We encourage you, as the parents, to please ask questions about your baby’s care or concerns you have. For additional information on your baby’s care please ask your baby’s nurse or doctor.
Appendix G

Recommended Rectal Temperature Trajectory for Cooling

Name: 
DOB: 
TOB: 

Temperature °C

Time from start of cooling (hours)

Optimal Cooling Rate

Target 33-34°C

Actions taken to achieve temperature control

<table>
<thead>
<tr>
<th>Time</th>
<th>Sign/Date</th>
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Active Versus Passive Cooling During Neonatal Transport. Rajiv Chaudhary, Kate Farrer, Susan Broster, Louise McRitchie and Topun Austin Pediatrics 2013;132;841; originally published online October 21, 2013; DOI: 10.1542/peds
Appendix H

Temperature Record for Passive Cooling at Referring Hospital

Passive Cooling at Referral Hospital

Vital Signs Record

DOB: ___ ___ ___ Time: ___ : ___ 1ST Temperature after Birth: Date: ___ ___ ___ Time: ___ : ___

Radiant Warmer turned off: □ No □ Yes: Date: ___ ___ ___ Time: ___ : ___

Ordered By Doctor: ___________________________ MD

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>15”</th>
<th>30”</th>
<th>45”</th>
<th>1 hr</th>
<th>1hr 15”</th>
<th>1hr 30”</th>
<th>1hr 45”</th>
<th>2 hrs</th>
<th>2hrs 15”</th>
<th>2hrs 30”</th>
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<tbody>
<tr>
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<td>Axillary °C</td>
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<td>Glucose</td>
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</table>

Goal: Maintain baby’s Temperature between 34°C-36°C (93.2 ºF-96.8 ºF)
Temperature: Every 15 minutes, HR, BP every 30 minutes
Glucose: on admission than every hour if stable.

Comment:

Date/Time RN Signature Date/Time RN Signature

__________________________________ ___________________________
__________________________________ ___________________________
## Appendix I

**Temperature Record for Passive Cooling and Rewarming in NICU**

**Passive Cooling Temperature Record at SCVMC NICU**

<table>
<thead>
<tr>
<th>Admit Date: ___ ___ ___</th>
<th>Time: ___ : ___</th>
<th>Admit Temp: ___</th>
<th>Time: ___ : ___</th>
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</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>15°</th>
<th>30°</th>
<th>45°</th>
<th>1 hr</th>
<th>1hr 15°</th>
<th>1hr 30°</th>
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<th>2 hrs</th>
<th>2hrs 15°</th>
<th>2hr 30°</th>
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</table>

**Intervention**

**Goal:** Maintain baby’s Temperature between 34 °C-35°C (93.2 °F-95°F)

**Total Body Cooling (TBC):**

**YES** – Continue recording temperature on NICU Induced Hypothermia Temperature Record

**NO** — Continue recording temperature using the log below

### Passive Re-warming Temperature Record

<table>
<thead>
<tr>
<th>Time: ___ : ___</th>
<th>30°</th>
<th>1 hr</th>
<th>1hr 30°</th>
<th>2 hrs</th>
<th>2hr 30°</th>
<th>3hrs</th>
<th>4hrs</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

**Intervention**

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>RN Signature</th>
<th>Date/Time</th>
<th>RN Signature</th>
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</table>
Appendix J
Screening for Hypothermia Therapy for Infants with HIE

QI Form

<table>
<thead>
<tr>
<th>Field</th>
<th>Information</th>
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</thead>
<tbody>
<tr>
<td>Birthing Hospital</td>
<td>____________________________</td>
</tr>
<tr>
<td>Patient ID</td>
<td>_________</td>
</tr>
<tr>
<td>DOB/TOB</td>
<td>___________ GA _______ BW ___________ Apgar@1___Apgar@5____</td>
</tr>
<tr>
<td>Criteria for screening</td>
<td>Apgar &lt;6 at 10 minute pH&lt;7 BD</td>
</tr>
<tr>
<td></td>
<td>PPV at 10 minutes of life CPR use of</td>
</tr>
<tr>
<td></td>
<td>epi/resuscitation drugs/blood?</td>
</tr>
<tr>
<td>Perinatal event</td>
<td>(Abruptio, Fetal distress, Cord prolapse, Uterine rupture, maternal trauma)</td>
</tr>
<tr>
<td>Cord gas UA/unmarked</td>
<td>pH ____ pCO2 ____ Base deficit ____</td>
</tr>
<tr>
<td>Cord gas UV/unmarked</td>
<td>pH ____ pCO2 ____ Base deficit ____</td>
</tr>
<tr>
<td>1st Baby gas</td>
<td>date/time: _______ pH ____ pCO2 ____ Base deficit ____</td>
</tr>
<tr>
<td>Heat sources removed</td>
<td>date/time: ___________ Temp monitoring began:</td>
</tr>
<tr>
<td></td>
<td>date/time: ___________</td>
</tr>
<tr>
<td>Lowest temp</td>
<td>°C/F rectal / axilla / skin (please circle one) date/time: ___________</td>
</tr>
<tr>
<td>Highest temp</td>
<td>°C/F rectal / axilla / skin (please circle one) date/time: ___________</td>
</tr>
<tr>
<td>Time to reach temp 33-34°C</td>
<td>_______</td>
</tr>
<tr>
<td>Seizure</td>
<td>Yes No suspected/unsure If yes, date/time: ___________</td>
</tr>
<tr>
<td>Lowest Glucose value in the 1st 6 hours of life</td>
<td>____ date/time: _______</td>
</tr>
<tr>
<td>Called cooling center?</td>
<td>Yes No If yes, date/time: _______</td>
</tr>
<tr>
<td>Cooling center</td>
<td>________________________________</td>
</tr>
<tr>
<td>Advice given about cooling</td>
<td>observe / passive / active / intermediate (explain):</td>
</tr>
<tr>
<td>Transferred?</td>
<td>Yes No If yes, date/time: ___________</td>
</tr>
<tr>
<td>Cooled on transport?</td>
<td>Yes No intermediate</td>
</tr>
<tr>
<td>Cooled at the cooling center?</td>
<td>Yes No If yes, date/time: ___________</td>
</tr>
</tbody>
</table>
Kathi Salley-Randall
RN, MSN, CNS, NNP-BC

Kathi is the founder of Synapse Care Solutions, an education and consulting company dedicated to supporting Neonatal Neuro-Critical Care Units. Through Synapse Care, Kathi offers NeuroNICU program consultation, in-person workshops, online courses, and an annual nurses’ conference. The ONE Conference focuses on the fact that Every NICU is a NeuroNICU and that ONE person can make a difference in their NICU; ONE baby, ONE family, and ONE moment at a time.

Kathi has been helping hospitals implement bedside aEEG brain monitoring into the NICU for more than a decade with her online aEEG Mastery Courses and monthly free Q&A sessions. Over the last 5 years, Kathi has been spending her time with the NeuroNICU Team at Stanford University and traveling the globe supporting NeuroNICU programs throughout the US, Thailand, Lebanon, Oman, and Brazil. She is a frequently invited speaker at international conferences with a focus on educating others on the use of aEEG, therapeutic hypothermia for HIE, and creating Neuro-Nurturing NICUs.

To contact Kathi or learn more about her NEW online Brain Cooling Course, her aEEG programs or the next ONE Conference - a NeuroNICU Nurse Training Course, you can follow her on social media or visit the Synpase Care website at: www.synapsecare.com

Email: kathi@synapsecare.com