Creating a NeuroNICU: People, Practices, Possibilities

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Outline
• What is a NeuroNICU
• Why the NeuroNICU Trend
• How we created a NeuroNICU

4 Pillars of Neuro-NICU Care

WHAT?
How do we assess the brain?

Pillar #1: Neuro-Assessment
Training included detailed neonatal neuro exam, Sarnat, and Neonatal Pain, agitation, and sedation Scale (N-PASS)

Specialized Imaging
MRI/MRS, Ultrasound, CT (for emergencies/trauma), F-MRI, PETs

Pillar #2: Bedside neuromonitoring devices
Continuous video EEG (cEEG)  Amplitude integrated EEG (aEEG)  Near infrared Spectroscopy (NIRS)

BRAIN FUNCTION  BRAIN PERFUSION
Pillar #3: Neuro-Protection

- Initially the term (NP) applied to treatments and cares to prevent injury and cell death
  - IVH Prevention
  - Therapeutic Hypothermia
  - Cocktails on Ice

Pillar #4 - Neuro-development

The 4 Pillars of Neuro-Conscious NICU

- **Neuro-Assessment**
  - Clinical /pain assessment
  - Metabolic
  - MRI/MRS
  - Ultrasound
  - Follow up care

- **Neuro-Monitoring**
  - EEG
  - aEEG
  - NIRS
  - Hearing Screen
  - N-Trainer

- **Neuro-Protection**
  - Cooling
  - Medications
  - Nutrition
  - IVH Bundles (Head position, etc.)

- **Neuro-Development**
  - Environment
  - Sleep
  - Stress/Seperaion
  - Positioning
  - Support during procedures

POSSIBILITIES FOR ALL
Where are you now? Where are you going?

• Neuro-NICU’s can be a:
  • QI project
  • Expanded Program
  • New unit design/environment
  • Change in culture

Why is there a NeuroNICU Trend?

• Recognition of improved survival with increased morbidities
  • Taking advantage of our local expertise in fetal medicine, neonatal intensive care, neonatal neurology, pediatric neuroradiology, pediatric neurosurgery, and high-risk infant follow-up to focus on brain care
  • Bringing new care practices and research findings to the bedside
  • To improve the short and long term outcomes for infants and their families.

Neonatal Brain Injury

• There are a number of causes and diagnoses
  • Outcomes depend on location, timing, extent of injury, interventions
Perinatal-Neonatal Brain Injury

- The incidence of neurological disabilities related to perinatal brain injury has not decreased in decades
  - CP, Cognitive impairment, Epilepsy
  - Term and preterm infants are affected


What we still don’t know

- On the basis of our follow-up data we feel that the size of the hemorrhage on ultrasound is by no means the only guideline to outcome.
- There may well be other factors influencing the result which we cannot yet diagnose by ultrasound.

VON: Mortality and major morbidity among survivors, 2000 vs. 2009

IQ scores at 26 years (n=359)
What we still don’t know

Neither structural brain alterations nor the medical complications common in the NICU population fully explain the variation in long-term neurobehavioral development

Milgrom, 2010

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Neuro-NICU’s: Getting above the clavicles

• UCSF NeuroIntensive Care Nursery – 2007
• Phoenix Children’s NeuroNICU – 2009
• Johns Hopkins
• St. Louis Children’s
• Vanderbilt Medical Center
• Children’s National Medical Center, Washington D.C.
• Boston Children’s - Peds Neuro ICU

• Lucile Packard Children’s at Stanford
• Loma Linda University Children’s Hospital
• Sharp Mary Birch & Rady’s Children’s – San Diego
• Riley Children’s – Indiana
• CHOC – Orange, CA
• And More...

The Neuro-Conscious NICU Team

- **Nursing**
  - Identification of Risk
  - Triage patient, staffing, equipment
  - Clinical Assessment
  - Apply equipment

- **Neurology**
  - Mechanism of injury
  - Coordinate application and interpretation of EEG/aEEG
  - Manage seizure

- **Neonatology**
  - Stabilize infant
  - Attention to physiology and diagnosis
  - Advanced Life Support

- **Family & Follow Up**
  - Prognosis
  - Long-term continuity
  - Support

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- To improve the short and long term outcomes for infants and their families.

HOW TO CREATE A NEURO-NICU?

Photo credit: @kyletdaddio - Twitter
ONE UNIT’S JOURNEY

The LPCH Journey

• 2012:
  • Written proposal and budget submitted,
  • Funding approved for equipment, training, and support staff
  • Decision to make “virtual” unit within the unit
  • Meetings with related departments to share vision
  • Develop and trend “top 10” list

Who could BE Served

• Term Infants
  • HIE
  • Induced Hypothermia
  • Seizures
  • Meningitis
  • Stroke
  • Cerebral Vascular Malformations
  • ECMO
  • Metabolic Disease

• Preterm infants
  • Developmental Care
  • Neuro-Protective Interventions
  • Seizures
  • IVH, PVL

Who will BE served at LPCH

<table>
<thead>
<tr>
<th>THE TOP 10 LISTS FOR LPCH</th>
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<tbody>
<tr>
<td>HIE/Cooling</td>
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<tr>
<td>Seizures</td>
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<tr>
<td>ECMO/pre-ECMO</td>
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<tr>
<td>Severe 3-4 IVH/hydrocephalus</td>
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<tr>
<td>Critical/unstable</td>
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<tr>
<td>Premie ≤ 28 weeks</td>
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<tr>
<td>CNS anomalies</td>
</tr>
<tr>
<td>Metabolic</td>
</tr>
<tr>
<td>Cyanotic CHD</td>
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<tr>
<td>CNS infection</td>
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</tbody>
</table>
### Top 12 priority diagnoses for Neuro NICU

<table>
<thead>
<tr>
<th>Priority</th>
<th>Diagnosis</th>
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<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HIE/cooling</td>
<td>7</td>
<td>Metabolic disease</td>
</tr>
<tr>
<td>2</td>
<td>Seizures</td>
<td>8</td>
<td>CNS anomalies or Primary neurologic disorders</td>
</tr>
<tr>
<td>3</td>
<td>ECMO/pre-ECMO</td>
<td>9</td>
<td>Cyanotic CHD</td>
</tr>
<tr>
<td>4</td>
<td>Critical/unstable</td>
<td>10</td>
<td>CNS infection</td>
</tr>
<tr>
<td>5</td>
<td>Preemie &lt;29 weeks</td>
<td>11</td>
<td>Symptomatic PDA</td>
</tr>
<tr>
<td>6</td>
<td>Grade III/IV or hydrocephalus</td>
<td>12</td>
<td>ALTE</td>
</tr>
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### The LPCH Journey

- **2013:**
  - aEEG Nurse Training – application
  - aEEG MD Training – interpretation
  - 3-Day NeuroNICU Training Courses, including hypothermia, NIRS and aEEG;
  - Nurse Staffing Organized
  - April - Opening of the NeuroNICU
  - Start NeuroNICU Database
The LPCH Journey

- **2014**
  - Annual course continues
  - Annual “skills” day for aEEG, NIRS, Cooling, Developmental Care
  - Add additional NNP hours for bedside coverage
  - Research:
    - CA Transport Cooling Trial – Servo vs Passive Cooling
    - Electrode Impedance QI project
    - Completed Optimized Cooling Trial
    - Late Hypothermia Enrollment

The LPCH Journey

- **2015**
  - Annual course + skills day continue
  - Add additional NNP hours for bedside coverage
  - Add aEEG documentation to nurse charting
  - aEEG Quiz for MD’s
  - Summer Case Study Series (bedside)

The LPCH Journey

- **2016**
  - Annual course + skills day continue
  - Hire part-time NeuroNICU Nurse Educator
  - Annual aEEG + NIRS Quiz for MD’s
  - Research
    - HEAL (High-Dose Epo Trial)
    - Premature Infant Cooling Trial
    - Transfusion of Prematurity + NIRS

The LPCH Journey

- **2017**
  - Annual course + skills day continue
  - Annual aEEG + NIRS Quiz for MD’s
  - Clinical Improvement Project = Seizures
    - Treatment Algorithm
    - Bedside Review of aEEG/Communication Audit
The LPCH Journey

Program Stats:
• 1 year anniversary – 226 patients
• 2 year anniversary – 260 patients
• 3 year anniversary – 370 patients
• 4 year anniversary – 494 patients
• Total 1,350 infants

Clinical service
• Specialized care by Neuro NICU trained RN team (n=90)
• Daily joint rounds with Neurology service
• On-site NNP or educator 5 days a week
• EPIC enhancements: Neuro NICU tab, dot phrases for neuro exam and aEEG interpretation, order sets for hypothermia and seizures
• Neuro NICU database in REDCap for research, QA/QI, and program planning

Education
• Annual didactic training (2-Day Course) – Open to the public – Next Sept 26-27, 2018
• Annual “skills day” for NeuroNICU nurses on aEEG, NIRS, cooling and developmental care
• Annual online review quiz for Medical Providers on aEEG, NIRS
• Weekly “5 Minute Friday Lectures”

Where are you now? Where are you going?
• Neuro-NICU’s can be a:
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  • Change in culture
Neuro-NICU Pillars

- **Neuro-Assessment**
  - Clinical/pain assessment
  - Metabolic
  - MRI/MRS
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- **Neuro-Monitoring**
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- **Neuro-Development**
  - Environment
  - Sleep
  - Stress/Separation
  - Positioning
  - Support during procedures

Framework of NICU Care

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<th>Practice</th>
<th>Personnel</th>
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<tr>
<td>Research/QI</td>
<td>Equipment</td>
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Final Thoughts

- Brain injury is a reality of many infants in the NICU.

- The brain is the organ that has the greatest impact on long term quality of life and function.

- We have the opportunity to improve the quality of life of high-risk infants, and the quality of care provided through the expansion of new technologies, therapies, and practices.

Resources

- [www.synapsecare.com](http://www.synapsecare.com)
  - Free webinars on various NeuroNICU topics
  - Upcoming hypothermia training course
  - Monthly developmental care book club
  - Monthly aEEG Q&A call – review cases + hot topics

- Annual NeuroNICU Nurse Training Course – Feb 2019 in San Diego, CA
THE One CONFERENCE
Neuro NICU Nurse Training
February 3-5, 2019
San Diego, CA
www.synapsecare.com
#onenurse
The ONE Conference will focus on the four pillars of Neuro NICU nursing care: Neuro-assessment, Neuro-monitoring, Neuro-development, and Neuro-protection.

Some featured topics:
- Advanced NeuroExam
- HIE updates
- Trauma Informed Care
- Pain in the Brain
- Using aEEG
- Touch & Massage
- Caregiver Fatigue
- Music Therapy

San Diego, CA
Kona Kai Resort & Spa

REGISTER NOW AT: WWW.SYNAPSECARE.COM

SPEAKERS INCLUDE:
Marsha Campbell-Yeo
Mary Coughlin
Lauren Heimall
Kathi Randall
Rachelle Sey
Jayne Solomon
Shannon Tinkler
Michelle Waddell
Kara Ann Waitzman
and more!

Download our FREE NeuroNICU Program & Practice QuickStart
www.quickstart.synapse.com
Resources

- **Innovative Care of the Newborn Brain**
  - Stanford University
  - 2 day Course
  - September 26-27, 2018
  - ONLINE REGISTRATION:
    - tinyurl.com/neuronicu-sept
Innovative Care of the Newborn Brain

September 26-27, 2018

Join us for a 2-day Neuro-NICU training course. In addition to our local experts in neonatology, neurology, developmental pediatrics and high-risk infant follow up care, we have several international experts joining us to provide a range of break-out sessions for beginners and advanced users of therapeutic hypothermia, aEEG and NIRS. This is a conference not to be missed!

Our Invited Guest Faculty

Lina Chalak
MD, MS Epi
Associate Professor in Pediatrics &
Attending Neonatologist
UT Southwestern Medical Center
Dallas, TX - USA

Dr. Lina Chalak's clinical and translational research expertise is related to neonatal brain injury, HIE identification and therapies, as well as the use of NIRS to evaluate neurovascular unit and cerebral auto-regulation.

Lena Hellström-Westas
MD, PhD
Professor of Perinatal Medicine
Senior Consulting Neonatologist
Uppsala University Hospital
Uppsala, Sweden

Dr. Lena Hellström-Westas is one of the pioneering clinical researchers on amplitude-integrated EEG monitoring with a focus on early prediction of outcome in asphyxiated infants and preterm infants, seizure detection, sleep and pain assessments.

Marianne Thoresen
MD, PhD
Professor of Neonatal Neuroscience,
University of Bristol, UK &
Professor of Physiology,
University of Oslo, Norway

Dr. Marianne Thoresen is considered one of the world’s leading experts on both the basic science and clinical use of neonatal hypothermia and other neuroprotective strategies. She has been cooling neonates since 1998 and played an important role in implementing hypothermia throughout the UK.
Course Description

This course has been designed to bring you an intense focus on one organ system, the neonatal brain and nervous system; the organ system that is ultimately responsible for our quality of life. We will take you on a journey from fetal life, through specialized care in the NICU, and finally beyond the doors of the NICU, to the infant’s real home.

Date & Time
- September 26 & 27, 2018
- 0800 to 1700

Location
Frances C. Arilloaga Alumni Center
326 Galvez Street—Stanford University

Registration
- $400 until June 1st, 2018
- $450 after June 1st; $500 at the door
- Registration Fee Includes: Printed Syllabus, Parking, Lunch and Light Snacks

Refund Policy
- 50% refunds will be given for cancellations received in writing by August 30th, 2018

Course Objectives
1. Identify risk factors, incidence and common causes; describe the pathophysiology, diagnostic work-up, two potential medical treatments, procedures, referrals; and list two nursing interventions or care considerations, for infants with the following conditions: • Hypoxic Ischemic Encephalopathy • CNS Malformations • Seizures • ELBW Infants

Full list of objectives and course schedule can be found online at: https://tinyurl.com/neuronicu-sept

Contact Information:
Shannon Tinkler—NeuroNICU Educator
Email: STinkler@stanfordchildrens.org

Krisa Van Meurs—NeuroNICU Medical Director
Email: vanmeurs@stanford.edu

Agenda + Registration
https://tinyurl.com/neuronicu-sept