

Thomas E. Young, MD NICU Blitz April 2011

Making the case for Kangaroo Care



Our world of the NICU

Comparing the NICU to the rest of the hospital:

- Our patients are in a crucial period of brain development
- No patient needs their family more not just emotionally, but biologically
- The experience may just as life-changing for the family as it is for the baby

The impact on the patient and the family are most profound, most long-lasting of any in the hospital – we are building brains and families every day!

Robert D. White, MD

Skin-to-skin (kangaroo) care: Background

As altricial mammals (newborns are unable to care for themselves for an extended period), the brain of newborn infants is exquisitely sensitive to multisensory input, especially from its mother. The baby begins to learn its mother's taste, smell, voice, and biorhythms before birth, although with preterm birth much of this vital time is spent outside the womb.

Robert D. White, MD



Kangaroo Care As we envision it now





Kangaroo Care The real story



Significant Ex utero Fetal Development

Why does it matter? Brain Development!

- Brain weight increases 400% from 26 weeks to term (in 3 months!)
- Brain weight increases
 400% from term to
 adulthood (in 18 years)



Why does it matter? Brain Development !



Kapellou, 2006

Myths about the preterm infant brain

- A blank slate
- Extraordinarily resilient
- "At rest" during sleep
- Too young for memory, sensitization, habituation, or conditioning in response to external stimuli

Early Experience Alters Brain Structure and Function

- NIDCAP randomized intervention study
- Kangaroo care studies
- High intensity parent training program
- Family care experience in Sweden

All confirm a much larger body of work in animals that establishes how crucial early interactions are in the days and weeks after birth

NIDCAP and Brain Development

Short Term Outcomes

- APIB (Neurobehavioral assessment) scores were better at 42 weeks PMA
- Bayley scores were better at 18 months
- Trends, but not significant differences in
 - Number of days on oxygen
 - Number of days to full PO feeds
- No differences in growth or length of stay

CONTROL



NIDCAP and Brain Development

Als H, et al. Pediatrics 2004:113:846-857.

NIDCAP



The NIDCAP group had more advanced white matter development in these regions

(greater fractional anisotropy)

Third trimester brain development

 Animal studies have established that the sensory environment has a profound impact on this connectivity, with long-term implications for learning and memory

• Think of enhancement of the neonate's sensory environment as *preventive neuroprotection*

Functional MRI demonstrates that our brain is a complex network of interconnected regions



Communication and integration of information between brain regions is likely a key factor in complex cognitive processes

Adult

Newborn

2.0 1.5

1.0 0.5



Functional Cortical Hubs "Connectomes"

Adults: Primarily areas associated with Higher cognitive functions

Newborns: Primarily areas associated with Sensation, Auditory, Visual, and Motor

Frannson, et al. Cerebral Cortex 2011

SENSATIONS THAT WIRE BRAIN



"That kangaroo care idea is nice for moms, but does it really matter to the baby?"

Environment of care	<u>Mother's</u> <u>Arms</u>	Incubator/ Warmer
Appropriate sound	X	
Familiar odors	X	
Circadian stimuli	X	
Kinesthetic	X	
Caress/massage	X	
Hormonal/immunologic/neural communication	X	
Protection	X	

Prematurity, Sleep, and State Organization

- Preterm infants compared to term infants
 - Spend shorter periods in alert wake and quiet sleep states
 - Spend longer periods in active sleep states, and
 - Show less organized sleep-wake rhythmicity.
- Earlier gestational age and greater severity of illness are associated with greater disturbances in state organization and a slower rate of maturation
- The degree of state organization at term postmenstrual age predicts neurobehavioral, cognitive, and motor development in infancy and early childhood

Kangaroo Care Effects on State Organization

- N = 70 (35 in each group), case-control study
- Gestational Age 25 33 weeks (mean = 30)
- Birth weight 540 1650 g (mean 1230 g)
- Kangaroo care mothers had to agree to 1 hour per day for at least 14 consecutive days
- Intervention started at 31 to 33 weeks PMA
- Infants were 'stable' but could be on NC oxygen and have IV fluids

Kangaroo Care improves NBAS (Brazelton) scores

Kangaroo care improved NBAS measures of

- Habituation
- Orientation

These correlate with neurobehavioral **maturation and competence**

Oxygen Desaturation Episodes by Sleep State in Ventilated Infants



Fig 2. Bars represent proportion of time (% \pm SD) spent in hypoxemia during each behavioral state in 13 ventilated ELBW infants. Differ-

Lehtonen JPediatr 2002

Kangaroo Care promotes more Quiet Sleep time



Feldman R, Eidelman AI. Dev Med Child Neurol 2003;45:274-81.

Vagal Tone

- An index for the integrity and maturity of the nervous system in preterm infants.
- Measures how much the heart rate varies with changes in respirations
- Heart rate variability and vagal tone correlate with a neonate's
 - clinical status, respiratory distress
 - gestational age, intrauterine growth rate, and
 - cry pitch frequencies.

Kangaroo Care leads to Higher Vagal Tone



Feldman R, Eidelman AI. Dev Med Child Neurol 2003;45:274-81.

Skin-to-Skin Care and EEG measures of Brain Maturation

- Eight study infants enrolled at 28 to 32 weeks PMA.
- Each infant received 90 minutes of SSC per day, 4 days a week, for 8 weeks.
- EEG recordings were conducted during two consecutive inter-feeding periods.
- Two control cohorts (N = 126) were recorded at term.
 - healthy preterm infants studied at term PMA.
 - healthy full-term infants studied at 1–3 days of age

Skin-to-Skin Care and EEG measures of Brain Maturation

Skin-to-skin contact accelerates brain maturation in healthy preterm infants

- Fewer REMs, more quiet sleep, increased respiratory regularity, and longer sleep/wake cycles when compared to the non-SSC preterm group at term.
- EEG wave complexity in the SSC preterm group was closer to the full-term cohort than the non-SSC group.

Early Sensitivity Training for Parents of Preterm Infants: Impact on the Developing Brain

- "PremieStart", a parent sensitivity training program, modified from the Maternal Infant Transaction Program (MITP)
- In MITP, parents are taught to recognize such things as
 - signs of infant stress
 - "shut-down" mechanisms
 - principles of graded stimulation
 - how to optimize interactions and avoid overwhelming infants
- Premie Start adds touch, movement, massage; kangaroo care;

Early Sensitivity Training for Parents of Preterm Infants: Impact on the Developing Brain

- MRI scans done at 38 to 42 weeks PMA
- No difference in brain volumes, but
- The PremieStart intervention was associated with improved white matter microstructure reflected by lower Apparent Diffusion Coefficient (ADC) values.

(If abnormally high ADC measures are noted in preterm infants at term-equivalent age, this has been shown to be predictive of later abnormal neurodevelopmental outcomes).

Milgrom J, et al. Pediatr Research 2010;76:330-335.

The Stockholm Neonatal Family Centered Care Study: Effects on Length of Stay and Infant Morbidity

- 2 NICUs, Level 2+, 15 beds ("Rex-like")
 - > 27 weeks, NCPAP, short term ventilation
 - Recent expansions with new family rooms
 - Old + new areas allowed for randomization
 - 4-bed ICU adjacent for unstable infants in both areas
- Standard care: parents encouraged to stay, but no overnight accommodations
- Family care: one parent was expected to be present 24/7.
- Room included infant bed, 2 adult beds, bathroom, (i.e. "suite")

Ortenstrand, et al. Pediatrics 2010;125:e278-85

Extended parental presence in Single Family Rooms improves outcomes n = 180 in each group

		FCC	SC	
LOS (in da	ys): <30 weeks	56.6	66.7	p=.02
	30-34 weeks	19.2	23.6	p=.16
ICU LOS:	<30 weeks	32.4	43.1	p=.04
	30-34 weeks	6.0	8.5	p=.02
Mod/seve	re BPD (%)	1.6	6.0	OR 0.18 (0.4-0.8)

Biggest impact on days in intensive care (rather than intermediate care)

• Adapted from Ortenstrand, et al. *Pediatrics* 2010;125:e278-85.

Skin-to-Skin Contact and Maternal Milk Volume

- Skin-to-Skin Contact significantly improves pumped milk volumes
 - Study in Houston with matched control group
 - VLBW infants 27 to 29 weeks gestation
 - No breastfeeding for first 4 weeks after birth
 - STS care for 1 hour, 4 times per week
 - Pumped milk volumes at 2 weeks were 20% higher
 - Volumes steadily increased over 4 weeks in STS group, versus no change in control group

Hurst NM, et al. J Perinatol 1997

Skin to Skin Care – Phase 1



Principles and Practice of SAFE skin-to-skin

"Put the patient in the best position for Nature to act upon him." Florence Nightingale



Implementing Kangaroo Care

- Assume it is the **norm for all babies**
- Exceptions:
 - Oscillator
 - Jet ventilator (maybe)
 - Peripheral arterial line, Low UVC
 - UACs and high UVCs are not an exception
 - Pressor therapy
 - Postop abdominal surgery (for at least several days)
 - With MD order
 - Phototherapy for bilirubin near exchange level
 - Unstable (significant) with handling

Implementing Kangaroo Care

- Remind parents, especially moms, that this is a good thing for their baby
 - Brain development
 - Bonding
 - Milk production
- No kangaroo by grandparents unless exceptional circumstances and verbal consent by mom and/or dad
- Discourage smoking
 - (? Request that they change clothes first)

The next set of challenges

- Frequent Skin to Skin Care for prolonged periods
- Skin to Skin Care in the period shortly after birth, and while the baby is still receiving intensive care
 - This may be even more important than later on when they are stable
- More frequent and more extensive family involvement in their baby's ongoing NICU care
- Designing our new NICU to accommodate and facilitate SSC and family – baby interactions

Implementing Kangaroo Care

- We need to work on:
 - Ensuring privacy, especially in the glass rooms
 - Having enough chairs and screens
 - Parent education materials
 - Ongoing staff education and support
 - Finding shirts/wraps to facilitate safe holding
 - Standardizing how we secure lines
 - Devising transfer method for babies in high humidity