

Developmentally Supportive Care and NIDCAP

Arvind Sehgal and Jacqueline Stack

Division of Newborn Care, Liverpool Hospital, South Western Sydney Area Health Service, NSW, Australia.

ABSTRACT

With increasing advances in field of perinatal medicine and new breakthroughs in technology, the perinatal mortality has shown a steady decline worldwide. This has given rise to a new dimension, that of developmentally oriented care of these sick neonates while they are still in intensive care. NIDCAP & developmentally supportive care is aimed at decreasing the stress levels in these babies by individualized care which also involves the family. Growth and development has been shown to get enhanced by this approach. There are only few well designed studies on this issue of extreme importance. This article presents a brief review of current literature as well as outlines relevant policies followed in the author's unit.

[*Indian J Pediatr* 2006; 73 (11) 1007-1010]: E-mail : sehgalarvind@yahoo.ca

Key words : Development; Newborn; NIDCAP

The Neonatal Intensive Care Unit (NICU) environment is dominated by life support systems of ever increasing complexity and in the midst of such technology, developmental assessment and care of the critically ill newborn is often relegated to being a "follow-up" issue. Though advances in neonatology have lead to increased survival of very premature babies, pulmonary morbidity and neurodevelopmental outcome remain two major issues of concern (1, 2). In the not so distant past newborns were considered to be unaware of their environment and unable to participate in meaningful interaction. But now we do know that they respond to touch, can differentiate between and show preference for certain stimuli, and they are capable of protecting themselves from the environment (e.g. by moving away from painful stimuli). In recent years, the advent of Neonatal Individualized Developmental Care and Assessment Program (NIDCAP) has lead to a greater emphasis on developmental care for high-risk infants and their families to enhance neuro-developmental outcomes.

Developmental care is an approach that uses a range of medical and nursing interventions that aim to decrease the stress of preterm infants in NICU.³ This article reflects current thought on this topic along with a brief description of relevant policies followed in the unit.

Developmentally Supportive Care

The concept of Developmentally Supportive Care underlines an approach that focuses on minimizing

noxious stimuli while individualizing infant care and stimulation based on observable physiologic responses & behavioral cues. A hierarchical framework for understanding premature infant behavior has been proposed by Al *et al* in their Synactive theory which forms the basis of developmentally supportive care.⁴

In practical terms, a well regulated infant generally maintains stable temperature, color, heart rate, respirations and saturations, and demonstrates good muscle tone, maintains tucked flexion at rest and during handling, and has smooth well modulated movements. He often establishes and maintains clearly defined sleep and awake states, moving smoothly between states, without much energy expenditure. On the other hand, a less well-organized ill term or preterm infant may have unstable cardiac functioning, changes in rate and character of breathing with desaturations and changes in skin colour. Tremors, startling, gagging, hiccoughs and spitting up are other responses. Motor responses may take the form of flaccidity of extremities and trunk, finger splays (opening hands and spreading fingers), facial grimacing & frowning and protective measures such as hand on face, arm extensions as if to signal "stop" (Fig. 1). Growth and development may be enhanced by consistently providing infants and their families with family-centered, developmentally supportive care.⁵

Development of human neonatal brain may be negatively influenced by conventional noxious NICU environments and practices. Experience of pain during neonatal period have been linked with long lasting accentuated pain responses, altered neuronal circuits, learning deficits, and behavioral changes in rodents. Chronic suppression of REM sleep results in behavioral changes in the adult and reduced cerebral cortical size.^{6,7}

Correspondence and Reprint requests : Dr. Arvind Sehgal, Neonatal Perinatal Fellow The Hospital for Sick Children, University of Toronto, Canada



Fig. 1. Self protective movements- signaling 'stop'.

It has been suggested that the infant's sensory experience in NICU environment, including exposure to bright lights, high sound levels, and frequent noxious interventions, may exert deleterious effects on the immature brain and alter its subsequent development. Als *et al*, in a study⁸ aimed at testing the neuro-developmental effectiveness of NIDCAP, randomized 30 preterm infants to intervention and control group. NIDCAP was initiated within 72 hours of intensive care admission and continued to the age of 2 weeks corrected for prematurity. They were assessed at 2 weeks' & 9 months corrected age for health status, growth and neurobehavior, and 2 weeks corrected age additionally on EEG spectral coherence and MR diffusion tensor imaging. The results showed better neurobehavior as well as increased coherence between frontal and occipital brain regions in NIDCAP group.

So far, there have been three randomized controlled trials (RCT).⁹⁻¹¹ on the effect of full implementation of NIDCAP on VLBW infants. In a meta-analysis, Jacobs and collaborators¹² report separately on these three trials and show a mean difference in length of ventilation of 27.7 days (95% CI 7.5 to 43.9) and reduced duration of oxygen requirement of 41 days ((95% CI 16.8 to 65.3). A Cochrane review³ also reported a relative risk for the NIDCAP infants of moderate- severe pulmonary radiographic findings of 0.34 (95% CI 0.15 to 0.81). In addition, a mean difference in the mental developmental index at 9-12 months of age of + 16.6 (95% CI 9.3 to 23.8) was described. A Cochrane meta-analysis¹³ including 20 studies, states positive impact on tube to bottle transition, behavior (improvement in sleep states, decreased stress behavior during gavage feeding), and length of hospital stay by using non-nutritive sucking.

Neonatal Individualized Developmental Care and Assessment Program (NIDCAP)

Encouraging parental participation : It is the endeavor of the whole medical & nursing team to demystify and

demedicalize the NICU environment for families. Parents are taught appropriate touch to "tune in" with the baby and to provide or assist with infant's care. Family needs are considered when planning care and feed times. This advocates an individualized approach to family centered care with emphasis on promoting infant organization and enhancing optimal neuro-developmental outcomes. The goal is to support the family by helping them to develop such care skills and techniques, thus including the family as a part of healthcare team. In order to promote family centered, developmentally supportive care, the health care team must recognize that the entire family experiences a crisis when their infant requires intensive medical care. They might feel a loss of control, grief regarding the loss of the perfect and healthy baby, uncertainty about the outcome, dealing with unfamiliar procedures and people; adjusting to their infant's altered appearance and not knowing what to do, how to act, or where to turn to for information and advice. The author's unit follows strategies to develop collaborative relationships and these include encouraging parental suggestions for, and participation in, planning and implementing care strategies for the infant, promoting and practicing open, honest communication among all members of the health care team and parents & sharing information in a timely and supportive manner. It's important to foster a non-judgmental atmosphere in which parents can openly express feelings and concerns. Altering the NICU environment is a component of NIDCAP.

The preterm infant's brain is extremely sensitive and has limited ability to buffer the vast amount of input. This input can be in form of noise, bright lights, handling and positioning. The US Committee to Establish Recommended Standards for Newborn ICU Design in its Fifth Consensus Conference¹⁴ has laid down guidelines for light and sound in NICU.

Noise

In utero, infants are exposed to sound of 40-60 dB, yet the NICU environ typically provides sound at 70-80 dB.¹⁵ An IV pump alarm can record 60-78 dB, tapping fingers at incubator: 70-95 dB, bubbling water in ventilator/hood tubing: 62-87 dB, closing a solid plastic porthole: 80-111 dB and pulse oximeter alarm: 86 dB. These can lead to startles, apneas, bradycardias, colour changes, desaturations, and alterations in blood pressure and cerebral blood flow, which may lead to IVH.¹⁵ It's important to promptly attend to, rather anticipate, monitor alarms, open and close incubator doors gently, use blanket coverings over incubator to decrease noise level. We provide soft music as auditory stimulus when appropriate, monitoring the infants response. Teaching rounds should be conducted in an unobtrusive manner. All these interventions are followed at the hospital's neonatal unit. A novel suggestion would be tape

Developmentally Supportive Care and NIDCAP

recordings' of parents' voices which may be tolerated by tiniest infant and may enhance parent-infant bonding.

Light

One of the most important stimuli is light, and bright light may come from phototherapy, procedure spot lights etc. It has been suggested over-stimulation may interfere with the development of the central visual system. The infants' overall socialization skills may also be affected. Bright lights increase the incidence of squinting and "shutting out" behaviors, whereas when exposed to reduced levels of lighting, infants seem more interested in and capable of engaging. Policy at our unit includes dim lights, maintaining a safe level of accurate clinical observation as well as modifying lighting to simulate day-night patterns. Individualized bedside lighting is used and incubators are covered with blankets. Adequate eye protection is provided while receiving phototherapy or during procedures like IV cannulation. There should also be a two hour period in afternoon, the 'quiet time', in which all non-urgent procedures be suspended, and babies given an opportunity for an afternoon nap.

Tactile stimuli

The unborn infant lives in a warm, fluid-filled environment, gently rocked by constant oscillations of amniotic fluid. Care-giving at NICU can be intrusive and stress producing. It may also contribute to aversive behavior and they may associate all touch with pain, responding by squirming, crying, and recoiling his arms and legs. Handling the infant gently, avoiding sudden changes in posture will help promote their tactile and vestibular development. Talking to them prior to touching and repositioning them is also helpful. We consistently provide comfort measures with traumatic and painful procedures. Assisting the infant in achieving a calm and regulated state before beginning an intervention may improve tolerance and help him recover more easily. Blanket rolls are provided to define boundaries. It is important to coordinate blood sampling, X-rays and multi-disciplinary activities, and allow adequate "rest-periods" or "quiet times".

Nursing staff at our unit observe the following policy while doing cares on babies. Interruption is avoided in an infant who has achieved deep sleep. If the intervention can be briefly postponed, we wait until the infant transitions to light sleep or drowsiness before beginning cares. Infant's arousal to more awake state is facilitated by speaking softly while gently touching his head or back. Infant's readiness and availability for interaction is assessed and lighting and noise is reduced. They stay at bedside for several minutes after completing care to ensure that the infant has returned to drowsy or light sleep states. If necessary, containment is provided by placing a hand on the infant's back and speaking softly until he has successfully returned to sleep. A

multidisciplinary team participates in discharge planning, which includes medical and nursing staff, social worker, health visitor, community nurse, dietician, development and supportive nurse along with parents.

Strategies in the developing world

Many aspects of developmentally 'humanized' supportive care are already in place and have been pioneered in developing countries. Exceptional amongst them is kangaroo care. Offering parents the opportunity to hold their infant "kangaroo style", is an important part of tactile care. Kangaroo holding may help facilitate the family's psychological healing, enhance parent-infant bonding, and improve lactation. Cochrane review of studies on kangaroo care,¹⁶ most of which have been done in developing countries, have recorded improved growth. Parental involvement can be much increased and improved. Allowing parents into the NICU, rather than a door-step update will go a long way in relieving anxiety. Talking to babies, reducing noise & light levels, administering small amount of sucrose or breast milk prior to sampling are features that can easily be adapted. Clinical Nurse Educators can play a big role in shaping the future direction of nursing care. The practices mentioned here can serve as guidance but each unit has to adapt keeping in mind respective cultural and traditional issues.

In conclusion, developmentally supportive care is individualized rather than protocol driven. What works for one infant may or may not work for another. In addition, what works for an infant today may or may not work for the same infant tomorrow. Therefore, ongoing assessment and evaluation of the infant's behavioral cues are needed to plan appropriate care giving strategies. Although the theoretical framework underlying developmental care interventions is supported by research, the trials have been relatively few and with small number of infants.

REFERENCES

1. Vaucher YE. Bronchopulmonary dysplasia: an enduring challenge. *Pediatr Rev* 2002; 23: 349-358.
2. Bregman J. Developmental outcome in very low birth weight infants. Current status and future trends. *Pediatr Clin North Am* 1998; 45 : 673-690.
3. Symington A, Pinelli J. Developmental care for promoting development and preventing morbidity in preterm infants (Cochrane Review). *Cochrane Database Syst Rev* 2003; 4: CD 001814.
4. Als H. Toward a Synactive theory of development: Promise for the assessment of infant individuality. *Infant Mental Health Journal* 1982; 3(4): 229-243.
5. Als H. *Manual for the naturalistic observation of newborn behavior (preterm and full term infants)*, (revised edition). Boston MA: The Children's Hospital 1984; 14-16.
6. Anand KJ, Coskun V, Thirivikraman KV, Nemeroff CB, Plotsky PM. Long term behavioral effects repetitive pain in neonatal

Arvind Sehgal and Jacqueline Stack

- rat pups. *Physiol Behav* 1999; 66: 627-637.
7. Mirmiran M. The importance of fetal/neonatal REM sleep. *Eur J Obstet Gynecol Reprod Biol* 1986; 21: 283-291.
 8. Als H, Duffy FH, McAnulty GB *et al*. Early experience alters brain function and structure. *Pediatr* 2004; 113(4) : 846-857.
 9. Als H, Lawhon G, Duffy FH, McAnulty GB, Gibes-Grossman R, Blickman JG. Individualized developmental care for the very low birth weight preterm infant. Medical and neurofunctional effects. *JAMA* 1994; 272: 853-858.
 10. Fleisher B, Vandenberg K, Constantinou J *et al*. Individualized developmental care for the very low birth weight preterm infants improves medical and neurodevelopmental outcome in the neonatal intensive care unit. *Clin Pediatr* 1995; 34 : 523-529.
 11. Westrup B, Kleberg A, von Eichwald K, Stjernqvist K, Langercrantz H. A randomized controlled trial to evaluate the effects of NIDCAP in a Swedish setting. *Pediatrics* 2000; 105 : 66-72.
 12. Jacobs SE, Sokol J, Ohlsson A. The Newborn Individualized Developmental Care and Assessment Program is not supported by meta-analysis of data. *J Pediatr* 2002; 140: 699-706.
 13. Pinelli A, Symington J. Non-nutritive sucking for the promotion of physiologic stability and nutrition in preterm infants. *Cochrane Database Syst Rev* 2001; 3: CD 001071.
 14. Committee to Establish Recommended Standards for Newborn ICU design. Recommended Standards for Newborn ICU design (Fifth Consensus Conference on newborn ICU Design 2002). <http://www.nd.edu/~kkolberg/DesignStandards.htm>.
 15. Thomas K. How the NICU environment sounds to a preterm infant. *Maternal-Child Nursing* 1989; 14 : 249-251.
 16. Conge-Agudelo A, Diaz-Rossello JS, Belzian JM. Kangaroo mother care to reduce morbidity and mortality in low birth weight infants. *Cochrane Database Syst Rev* 2000; (4): CD 002771.
-