Developmental Supportive Care

Dr C Manigandan MD DCH MRCPCH FRCPCH CCT (Neo)
Consultant Neonatologist
Overview

• Background

• Definition

• Components

• Outcome
Background

• NICU Developments - survival of preterm infants

• Sensory, cognitive, communication, motor, and neurodevelopmental sequelae – no improvement

• High risk of developmental health issues and early regulatory disorders
Ideal situation

- Warm
- Gentle movements
- Dark
- Quiet
- Flexion
- Constant
- Containment
- Firm boundaries
- Proprioceptive feedback
Gravity dependent Procedures Inconsistency

Rapid positional changes Varied temperatures

Bright lights Noisy

Reality
Problems....

- In 24 hours, VLBW infants - handled on average more than 200 times

- 75% hypoxemic episodes in preterm infants - associated with the care giving itself

- Increased concentrations of stress hormones - with routine nursing procedures.

Background to emergence

• Intentional as well as unintentional sensory input to the immature CNS of a preterm infant influences long term development!

• Lack of sleep & lack of sleep cycle maturation negatively influence CNS development!
Background to emergence

CNS maturation – occurs well in a uterine environment where the fetus is protected

Graven, 2006
Emergence of DSC

• Primary goal - neurodevelopmental outcomes of high-risk newborns

• Early recognition - physiologic impact of the acoustic environment and handling

• To understand the detrimental impact of overwhelming sensory input and procedures on the developing newborn brain

• Simultaneously, the unique behavioral organization of the high-risk newborn was being described
DSC - Definition

Care of an infant to support positive growth and development, while allowing stabilization of physiologic and behavioral functioning
Philosophy behind DSC

1. Attention and responsiveness to the limitations and needs of the immature central nervous system

   – Energy conservation for growth & maturation

   – Prevention of pain, fatigue & stress responses to hypothermia, environmental noise & light, invasive procedures, prolonged handling and unsupported positioning
Philosophy behind DSC

2. Attention and responsiveness to the behavioral and physiologic cues of infants as a guide to ALL care-giving practices

– Clustering periods of handling to meet the infant’s need for recovery during or following care-giving and for sustained sleep

– Provision of developmentally appropriate, well tolerated sensory input on consistent basis
Goals

1. Reduce stress and pain

2. Conserve energy and promote physiological stability

3. Recognize and support infants emerging neurodevelopment maturity

4. Provide support and encouragement to parents
Principles to achieve goals

- NICU design and environment
- Nursing care routines & plans
- Use of positioning aids
- Use of self regulation aids
- Feeding methods
- Management of pain
- Parental participation & support
- Neonatologist’ attitude
Medical care
• Physiologic stability
• Meds
• Management
• Vital signs
• Respiratory care
• Feeding

Developmental care
• Stress cues
• Positioning
• Infant driven feeding
• Infant massage
• Parent education

Bridging the Gap
Environment
Infant states

- **Quiet sleep** - regular breathing, no REM, no spontaneous movements.
- **Light sleep** - irregular breathing, REM, spontaneous movements.
- **Transition / drowsy** - variable activity, dull look
- **Awake** - alert - minimal activity, bright look.
- **Awake** - hyperactive - very reactive, fussy, increased motor activity.
- **Crying**
Signs of neonatal stability

• **Autonomic**: Stable colour, stable heart & RR, feeding tolerance

• **Motor**: Flexed or relaxed posture, hand to mouth / sucking

• **State**: Clear sleep state, interaction

(Gupta G, 2001)
## Signs of neonatal stress

**Signs of autonomic or physiologic instability**
- Periodic breathing & apnea
- Tachypnea
- Tachycardia
- Skin mottling
- Hiccups
- Straining or Grunting
- Tremors
- Low threshold startles
- Signs included in pain scales

**Signs from stress include:**
- Neck & trunk arching
- Frantic or jerky extremity movement
- ‘sitting on air’
- Salutes with finger splaying
- Limp extremities
- Gapping facial expression
Light exposure

• Light & deep sleep differentiation plays a role in CNS maturation

• Some studies report increased weight gain from consistent day-night cycles of lighting

Adverse effects include

– Brain impairment
– Increase in ROP
– Physiological instability
Light exposure reduction

- Dimmers placed over the neonatal cot

- Blinds / curtains can be used to shade bright light. Use Incubator covers

- Avoid fluctuating bright light on the baby’s eyes during care giving procedures.

- Darkness at night

- Provide eye protection
Light exposure recommendation

• Examine the infant - range of general illumination of 10-600 lux.

• Avoid direct light to the newborn infant’s eyes at all times

• Implement a cyclic lighting schedule.
  – During day, between 100 and 200 lux, with some natural light
  – At night, artificial light lower than 50 lux
Adverse effects of loud sound > 60 db

- Interferes with sleep
- Increase in Heart Rate
- Peripheral vasoconstriction
- Sudden loud noise may decrease PCO$_2$, and increase in IVH
- Hearing loss
Noise reduction

- Decrease monitor noise
- Respond quickly to alarms
- Rounds & reports away from bedside
- Speak softly
- Decrease telephone & intercom noise
- Move equipments quietly
- Decrease staff generated noises
- Prepare medications & feedings away from bedside
- Gently open doors and drawers
- Follow the sound limit recommendations
Noise recommendation

- Recommended noise level < 45 db – AAP

Beneficial sounds
- Sound of mother’s voice (calming effect)
- Music beneficial
- Lullabies, womb sound, heart beat music.
  - Better weight gain
  - Decreased hospital stay
  - Better behavioral organization

(Chapman JS, 1998)
Positioning - key

• It helps respiratory physiology
  – Supporting the rib cage

• Reduces reflux

• Gets hand to mouth

• Increases time spent in quiet sleep
  – saves energy
  – faster weight gain
Positioning guidelines

Recommendations
• Preferred, Prone / side lying
• Swaddle / cover to keep in flexed position
• Attempt to “nest” the infant
• Promote midline alignment
• Head support

Avoid:
• Hyperextension of neck
• Frequent head turning to side
• Lower extremity frogging
• Bigger diaper
Nesting

Step 1 – Roll the towel

Step 2 – Fold towel into a “U” shape

Step 3 – Add a second rolled towel to snuggly fit the baby in the flexed position

Step 4 – Cover with a soft cloth and tuck it in

Step 5 – The completed nest
Nesting positions
**Touch and Handling**

**Touch**
- Tactile support - nurturing touch
- Reduces tactile sensitivity
- Encourages bonding and attachment
- Provides a pleasurable positive touch experience
- Encourages an improved range of motion and relaxation for baby

**Handling**
- ‘Quiet time’
- Allow minimum two hours of rest
- Cluster the caregiving procedure
- Sensitize the nursing staff
Kangaroo Mother Care
KMC

- Continuous, prolonged, early skin to skin contact between a baby and mother/other adult
- Provides warmth, promotes breastfeeding, reduces infections

Who and When?

- Preterm/low birth weight babies (i.e. <2000g or preterm <34wks)
- Clinically stable (i.e. not requiring recurrent resuscitation)
Benefits - KMC

1. Temperature maintenance with a reduced risk of hypothermia
2. Increased breastfeeding rates
3. Early discharge from the health facility
4. Less morbidities such as apnea and infections
5. Less stress (for both baby and mother)
6. Better infant bonding
Meta-analysis – Neonatal Mortality

- 3 RCTs, N 1075

- RR 0.49 (0.29, 0.82)

- 51% reduction in neonatal mortality for neonates <2000 g with facility-based KMC compared to conventional care

OTHERS
Non-nutritive Sucking

- Different from nutritive sucking
- On empty breast
- Provides comfort
- Promotes physiological organization
- Pain-reducing effect
- Promotes suck-swallow co-ordination
- Facilitates transition to breast feeding
- Better weight gain & shorter hospital stay
Massage Therapy

- Tactile / Kinesthetic stimulation

- Tactile stimulation only - may be aversive

- Massage therapy with moderate pressure may be useful

- Stimulation of tactile and pressure receptors Important

- Hypothetical mechanisms of benefit
  Touch - Growth gene interaction
  Increased vagal tone
  Increased insulin levels
  Increased growth hormone secretion

Benefits

- Better weight gain

- More time in active, alert state

- More quiet sleep

- Better motor maturity scores
NIDCAP

• **Neonatal Individualized Developmental Care and Assessment Program**

• Systematic method of recording observations of an individual infant’s behavioral cues 20 minutes before, 20 minutes during and 20 minutes after care procedures.

• Multiple observations are needed

• Requires extensive training to administer and interpret
NIDCAP

- Developed by Als et al
- Four standards of care
  - Structuring the environment
  - Timing, organizing & giving direct care
  - Working collaboratively
  - Supporting & strengthening family relationships.
- Individualized plan for each baby
- Meta-analysis: Significant decrease in O2 requirement and Improved outcome at 12 months

Jacobs SE et al, J Ped, 2002
## Pain Management

### Misconceptions

- Newborns lack anatomical & physiological structures to transmit pain sensation
- Can not express pain sensation
- Have no memory of pain
- Would not tolerate anesthesia

### Facts

- Nociceptive mechanisms well developed even in preterm
- Pain expression and assessment possible
- Various consequences of pain & stress
Pain Management

Non-pharmacologic

- Positioning & containment
- Swaddling
- Non-nutritive sucking / pacifiers
- Skin to skin contact
- Rocking
- Music
- Breast milk
- Oral glucose / sucrose

Pharmacologic

- Local anaesthetics (EMLA)
- Regional anaesthesia
- Systemic analgesia
<table>
<thead>
<tr>
<th>Family Centered Care</th>
<th>Teach Mothers</th>
</tr>
</thead>
<tbody>
<tr>
<td>• NICU - a barrier</td>
<td>• Observe infant behavior</td>
</tr>
<tr>
<td></td>
<td>• Cares</td>
</tr>
<tr>
<td>• Provision of privacy (for bonding)</td>
<td>• Gentle touch</td>
</tr>
<tr>
<td>• Social interaction &amp; support</td>
<td>• Containment</td>
</tr>
<tr>
<td>• Parental education &amp; counselling</td>
<td></td>
</tr>
<tr>
<td>• Involvement of mother in care</td>
<td></td>
</tr>
</tbody>
</table>
Developmental care for promoting development and preventing morbidity in preterm infants (Review)

Symington AJ, Pinelli J

36 eligible RCTs

2006

Outcome

- Decreased moderate-severe CLD
- Decreased incidence of NEC
- Improved family outcome

Needs more studies
Summary

• Developmental Care is a philosophy of care that integrates the Developmental needs of each individual infant and their family within a medical framework

• Modification of the nursery environment and care practices which support the ongoing development of the infant are recommended from delivery onwards

• Education and involvement of Parents acknowledging that their role is pivotal is key to Family Centred Developmental Care delivery
The genes are the bricks & mortar to build a brain. The environment is the architect” - Christine Hohmann
Partnering with Families

Safeguarding Sleep

Positioning & Handling

Optimizing Nutrition

Smell

Sound

Touch

Temperature

Light

Protecting Skin

Minimizing Stress & Pain