Neuroprotective Care in the NICU
Small Baby Unit  July 2016
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Objectives
- Review NICU neuroprotective core measures
- Discuss sensory processing, what it is, and how it typically develops
- Discuss sensory processing development in the NICU environment
- Describe the various types of sensory processing disorder (SPD) and the clinical signs
- Discuss how we can apply what we know about sensory processing development to positioning and handling of infants in the NICU

Terminology
- Neuroprotection
  - protection against neuronal injury or cell death
  - minimize the damage
- Neurodevelopmental care
  - Intervention in the NICU to improve neuro-developmental outcome
  - Includes unit design, routines, pain management, feeding methods, parental involvement
- Neuroplasticity
  - Ability of the brain to modify and change the amount and strength of synaptic neuronal connections, based on experiences
  - The brain learns what the body practices
NICU Neuroprotective Core Measures

- Healing environment
- Partnering with families
- **Position and handling**
- Safeguarding sleep
- Minimizing stress and pain
- Protecting skin
- Optimizing nutrition

Sensory Processing...

- It begins in the womb and develops in childhood via
  - Intrinsic motivation to engage with the environment
  - Interaction with a variety of objects in the environment
  - Experiencing a variety of physical challenges during early childhood

- The first seven years are critical for sensory-motor development
The 5 Senses

There Are More than 5 Senses

- We also receive input through two additional senses:
  - **Vestibular sense**
    - Tells us where our head and body are in space.
    - Important for balance and upright posture
    - It allows us to stay upright while we sit, stand, and walk.
There Are More than 5 Senses

- **Proprioception**
  - Tells us where our body parts are in relation to each other
  - Important for body awareness
  - Gives us information about how much force to use in certain activities (ie holding a glass vs an egg)

Sensory Integration

- Most activities require us to integrate information from many different senses at the same time

- To drink from a cup, you use **vision and proprioception** to grasp the cup with the appropriate force and bring it to your mouth, **smell and taste** as you drink from the cup, and **vestibular system** to remain upright while drinking

*Think about the challenges our babies face with multi sensory bombardment at the same time....and sensory systems that are not mature enough to process the information*
Sensory Processing...What is it?

• How our nervous system takes in sensory information from the environment, organizes it, and uses it to generate a motor or behavioral response

• Effective sensory processing requires us to
  • Perceive and process multiple sensory input at the same time
  • Discriminate between useful information that should get our attention and information that should be ignored

Fetal Sensory Development

• Each system develops in a specific sequence
• Basic structures of the sensory systems (ie eyes, ears) develop early in gestation but…….

The building and coordination of neural pathways occurs between 22 and 40 weeks gestation, and in the 3-5 months after birth.³

Which would you choose?
Strengths and Weaknesses

WOMB
- Tactile
- Vestibular
- Proprioception
- Olfactory
- Taste
- Hearing
- Vision

NICU
- Tactile
- Vestibular
- Proprioception
- Olfactory
- Taste
- Hearing
- Vision

Fetal Sensory Development

Sequence of development:
- Tactile \(\rightarrow\) Vestibular & proprioception \(\rightarrow\) Olfactory and taste before 20w GA
- Hearing at 24-28w GA
- Vision is the most complex
  - Begins at 23-24w GA in a dark womb, matures after birth

*External stimuli and experiences after birth contribute to the growth and maturation of each system.*

Fetal Sensory Development

- Inappropriate external stimuli and repeated negative experiences
  - atypical neural wiring \(\rightarrow\) sensory processing disorders.

*Sensory processing disorder (SPD)*
- “The brain’s inability to organize sensory input for appropriate use”
- Associated with learning, developmental, and emotional disabilities.
Sub-Types of SPD

- **Sensory modulation disorder**
  - *Sensory over-responsiveness*
    - Respond too much, for too long
  - *Sensory under-responsiveness*
    - Respond too little, or needs extreme input to register awareness
  - *Sensory seeking/craving*
    - Strong drive for more intense input

- **Sensory discrimination disorder**
  - Difficulty interpreting the characteristics of the sensory input, (e.g. duration and intensity)
  - Difficulty determining what is important and what to ignore

- **Sensory-based motor disorder**
  - Postural disorder: Affects balance and core stability
  - Dyspraxia: impaired motor planning due to lack of motor memory
    - The clumsy child

Signs of SPD

- Infant:
  - Difficulty falling asleep and staying asleep
  - Frequent crying, inconsolability
  - Strong startle response
  - Resist being held or cuddled
  - Avoidance of eye contact
  - May show preference for specific caregivers due to voice tone and tempo, smell and touch
  - Oblivious to people and surroundings
  - Poor state regulation during feeding
  - Hands fisted and resistant to exploring toys
Signs of SPD²,⁸
- Toddlers and older children
  - Hyperactivity or very low activity level
  - Easily distracted; poor attention span
  - Fretful, overly sensitive, low self esteem
  - Delays in speech, motor skills,
  - Poor school performance \(\rightarrow\) low self esteem
  - Awkward or clumsy
  - Difficulty learning new tasks
  -Immature social skills
  - Impulsive, lack of self control

Preterm Infants at Increased Risk for SPD⁷
- SR of literature by Mitchell et al to determine the incidence of SPD in children 0-3 years born preterm (< 37 weeks) or LBW (< 2500g)
  - 44% with signs of SPD
  - Majority of those had SMD with over-responsiveness to sensory input
  - Recommendations:
    - Education of parents in the NICU on signs of SPD
    - Screen at-risk children for signs of SPD; educate pediatricians
    - Modify the NICU environment; provide neuroprotective care

Preterm Infants at Increased Risk for SPD⁷
- What is the incidence of SPD in graduates of our NICU?
- PDSA project June to December 2015
  - Screened babies <32 weeks GA at NICU discharge using the Infant Sensory Profile (ISP)
    - 35% of babies had atypical ISP scores
    - All were “over-responsive” to input
  - Collaboration with HRF at Stramski
    - NP administered the Sensory Profile at 2 year visit
    - 38% had atypical SP scores
  - Project is ongoing, with plans for a longitudinal study
• 25 weeks GA
• CA: 18 mos
• AA: 15 mos
What to do???

Neuroplasticity

• The brain learns what the body practices
• Positive and appropriate stimuli → typical development and prevents disabilities
• Neuroprotective interventions via the Core NICU measures
  • Healing environment
  • Partnership with families
  • Positioning and handling
  • Safeguarding sleep
  • Minimizing stress and pain
  • Protecting skin
  • Optimizing nutrition

Principles of Positioning

• Support optimal postural alignment
  • Midline head alignment
  • Shoulders rounded
  • Hands to midline, by the face
  • Hip flexion, posterior pelvic tilt
  • Foot bracing
• Provide opportunity for movement via flexible containment
Positioning for Diaphragmatic Breathing

- Infants are diaphragmatic and nose breathers
- Diaphragmatic breathing is supported by a tucked position
  - Neutral neck alignment
  - SCM muscles attach to ribs 1 & 2 and the clavicles
  - Neck extension → SCM stretch, pull ribs up and forward, changing breathing mechanics
  - Change in breathing mechanics from diaphragmatic to apical pattern
  - Posterior pelvic tilt with thoracic flexion
  - Shoulder extension, adduction
- Deep breathing also improves GI motility
  - Constipation → increased intra-abdominal pressure with impact on diaphragmatic breathing

Infant Position Assessment Tool (IPAT)

Handling and caregiving

- Two person touch time; ask for help
- Mindful presence
- Promote smooth transitions between sleep and awake states
- Support sustained calm state via facilitated tucking
- Provide slow controlled movement when changing positions
- Proprioceptive support via containment and tucked position
- Use sidelying as a rest and recovery position when moving baby between supine and prone
- Promote self soothing and movement exploration during cares
“One Brain for Life” Heidi Als

Every experience, every interaction counts!!!

References

5. Massery M. “If you can’t breathe, you can’t function.” December 5-7, 2014. Orange, CA.

References

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