

REVIEW ARTICLE

Nurses' Role in Strengthening Sensory Inputs of Premies in NICU

Renilda Shanthi Lobo^{1*}, Theresa Leonilda Mendonca²

¹City College of Nursing, City Enclave, Shaktinagar, Mangalore, India.

²Laxmi Memorial College of Nursing, Bendoor, Mangalore, India.

***Corresponding author:**

Renilda Shanthi Lobo, Principal, City College of Nursing, City Enclave, Shaktinagar, Mangalore, India.

E-mail: shanthid969@gmail.com

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Abstract

Infants born prematurely are deprived of the prenatal sensory stimulation necessary for their proper development, and the harsh environment in neonatal intensive care unit (NICU) severely impacts their growth. This paper aims to strengthen the mother-newborn interaction to promote healthy growth and development by implementing evidenced-based sensory care in NICU and thus reducing the newborn mortality rate. This paper is focused on the initiation of positive sensory inputs for the premies in the NICU based on evidence-based care to promote in-utero experience to the preterm newborn. The main sensory inputs include Octopus therapy, therapeutic positioning and nesting and multisensory stimulation including auditory, tactile, vestibular, and visual stimulations. The research studies have shown the benefits of sensory stimulation of preterm newborns in NICU in terms of growth of the child, neuromotor development, physiological stability, improvement in sleep, and improved mother-newborn interaction promoting adjustment of the newborn to the extrauterine life. Nurses play a very important role in initiating this sensory stimulation for the premies admitted to NICU with maternal participation in care.

Keywords: Sensory inputs, Premies, NICU, Preterm newborn, Nurses' role

Introduction

Globally, newborn health is increasingly regarded as a top national priority. Neonates who need extensive medical care are admitted to the neonatal intensive care unit (NICU), which aims to support their healing, growth and development. The newborn mortality rate worldwide is 17 for every 1000 live births, and 63 countries are not on track to fulfill the Sustainable Development Goals target for neonatal mortality. The UN Inter-Agency Group for Child Mortality Estimation (UN IGME) report recommends aiming for a 12 or lower newborn mortality rate for every 1,000 live births by 2030.¹ The babies at risk in NICU require more attention and it is important to implement evidence-based practices in NICU to promote

newborn health and strengthen the bond between mother and child. If we want to make sure that every child lives and develops to the fullest extent possible, we must focus on improving care during pregnancy and the first week of life. With practicable, affordable care, such as kangaroo mother care, and vital care for every mother and baby during pregnancy, delivery, and the postpartum period, more than three-quarters of premature babies can be rescued.²

Facts

- Babies born after 28 weeks of gestation and weighing 1 kg have a chance of survival.³

- Premature birth occurs in 5 to 18% of pregnancies.⁴
- Among the predicted five million deaths of children under the age of five in 2020, the majority were from preventable and treatable causes. About half of those fatalities, 2.4 million, occurred among newborns (in the first 28 days of life).²
- The leading causes of death in children under five years are preterm birth complications, birth asphyxia/trauma, pneumonia, diarrhoea, and malaria, all of which can be prevented or treated with access to affordable interventions in health and sanitation.²
- In lower-income countries, on an average, 12% of babies are born too early compared to 9% in higher-income countries.²
- Up to 50% of mothers giving birth to premature babies have no known risk factors.²
- Neurodevelopmental morbidities developed more commonly in low-birth-weight premature infants.^{5,6}
- Sensory systems of newborns are developed at birth.⁷
- Parents are given limited opportunity to interact with the preterm babies admitted in the NICU.⁸
- Parental participation is associated with improved developmental outcomes of newborns, and involving families in the NICU is crucial.⁸

Risk factors requiring NICU admission in neonates

In India, birth asphyxia, neonatal hyperbilirubinemia, sepsis, and problems due to prematurity are the most common reasons for admission to a secondary-level NICU. Within the confines of the current healthcare system, approximately three-fourths of neonates admitted can be effectively treated even in a secondary-level NICU with quality neonatal care.⁵ The risk factors related to mother, delivery and newborn are discussed below in Figure 1.

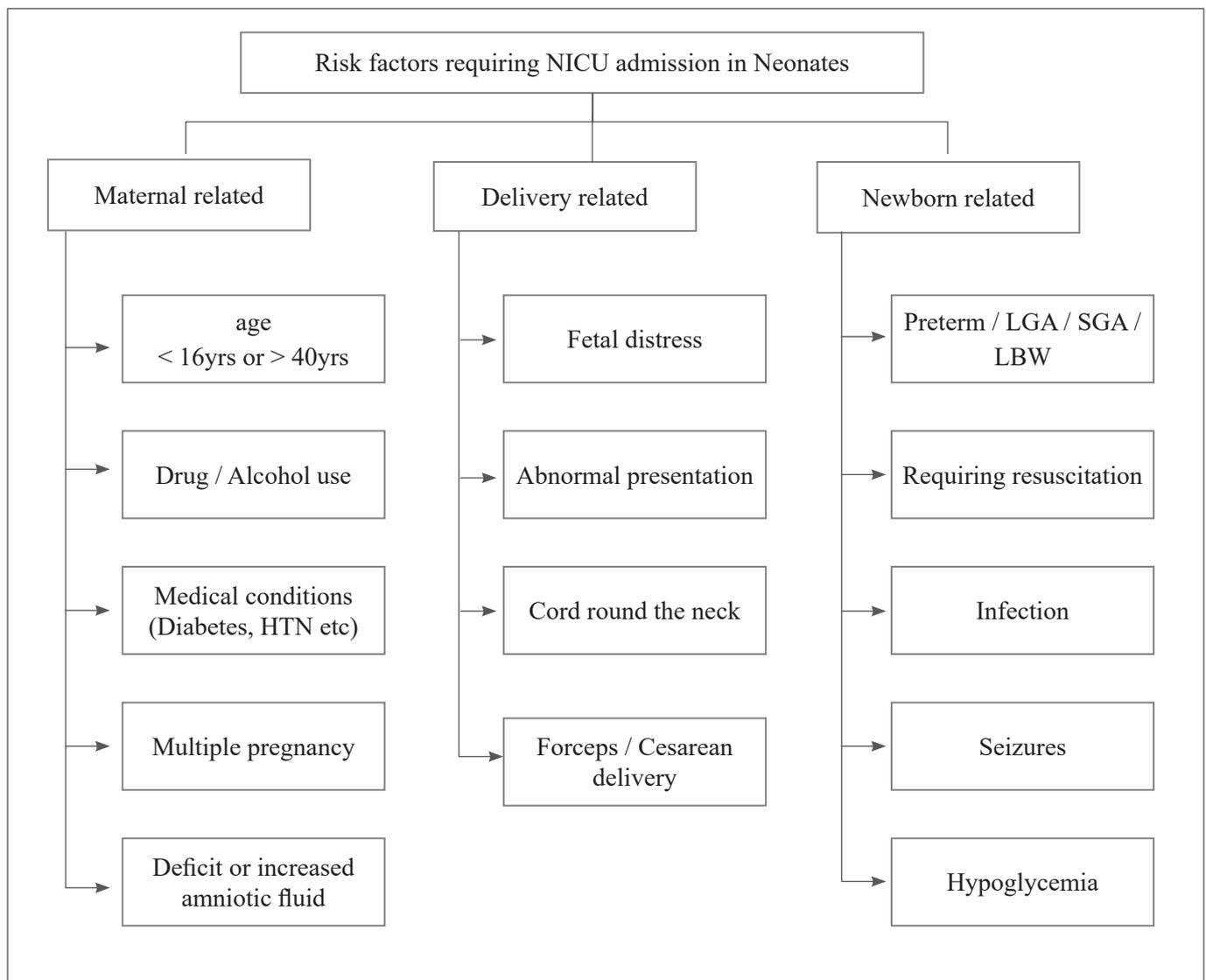


Figure 1: Risk factors related to NICU admission in neonates

Nurses' responsibility in initiation of positive sensory inputs for preemies

For preemie infants born early, the nurses working in the NICU need to create a favorable atmosphere so that the newborn grows into a healthy child without any neurodevelopmental compromise. The NICU environment exposes the preemie to separation from the mother, painful stimuli, and disturbances in sleep cycles.⁹

As per the evidenced-based practices, the preemies in NICU need to be given sensory developmental care which consists of the following:

a. Provision of the in-utero environment experience:

The developing fetus is protected from the unpleasant external stimulus by the intrauterine environment. The attributes that protect the fetus within the womb include, the uterine wall, which provides secure boundaries and containment for the developing fetus. We are aware that we will never be able to completely mimic what it feels like to be within a mother's womb, but we keep looking for solutions.

Actions to be taken in NICU: Octopus therapy for preemies initially originated at Aarhus University Hospital in Denmark in 2003 as an OCTO project. As per the CNN health news published in 2017, at Poole hospital in the United Kingdom, the neonatal intensive care unit (NICU) incubators house colorful, crocheted octopi, an odd companion for premature babies.¹⁰ Premature newborns are soothed and calmed using these soft toys as a type of treatment. Prior to starting therapy, the octopus may be placed for about 10 to 12 hours in Kangaroo Mother Care (KMC) with the preemie's mother in order to transfer the maternal body odor to the octopus. The octopus is placed next to the infant in the desired position following the completion of KMC session.¹¹



Figure 2: Crocheted octopi comfort and calm premature babies at Poole Hospital in the UK¹²

Benefits: These octopi are soothing because of their smooth tentacles, which babies associate with the umbilical cord and the womb of their mother. Babies who cuddle an octopus have less likelihood to rip out their monitors and tubes, the researchers discovered. With the octopi, some NICU infants showed improved breathing and more regular heartbeats, which led to higher oxygen levels in their blood. The newborn benefits from octopus therapy by being in a state of organization, having good self-control and sound sleep.^{10,11}

b. Therapeutic positioning and nesting: Premature birth deprives newborns of their normal spatial limitations (uterus walls). These factors, together with the effects of gravity to which they are exposed after birth, cause the neonates to have low muscle tone, develop an extended posture, become irritable, and struggle with their alertness-sleep cycle. To encourage neuromotor and neurobehavioral development in preterm and critically sick babies, therapeutic positioning is a practical and affordable strategy.^{11,13}

Actions to be taken in NICU: Preterm infants are least stressed when they are nested and lying in a prone position, and sufficient nesting with side-lying and supine positions also encourage soothing behavior.

Key points to follow

- Change position with each routine care
- Avoid pressure, friction, and shearing of fragile skin
- Position body symmetrically
- Do not restrict movement
- Support according to medical status
 - a) Full nest as able
 - b) Half nest if not tolerating full
 - c) Tiny baby's low nest
 - d) Bigger babies' bigger blankets

Benefits

- Promotes deep sleep, normal body flexion, physiologic stability and a sense of security
- Develops calming ability
- Saves energy and calories
- Helps muscle tone and behavioral state regulation
- Minimizes deformity
- Protects the developing brain.^{11,13,14}

c. Multisensory stimulation: There is a lot of promise for multimodal stimulation to help with prematurity-related sensory impairments during the NICU stay. Positive sensory impulses are replaced by negative sensory inputs as the brain develops, which can permanently change how the brain normally develops. The neurologic and sensory systems do not exist as separate entities but are interdependent and compromise the neurobehavioral and neurosensory development of infants. Sensory stimulation of preterm newborns is very important as the activity in the brain creates tiny electrical connections called synapses and the amount of stimulation is directly proportional to the synapses formed. Repetitive stimulations strengthen these connections making them permanent whereas unused ones eventually die out.^{11,15,16}

The sequence of development of senses in the newborn

The infant has a progressive pattern of maturation and growth. While providing stimulation to the preemies, it

is essential to know their maturity as well as to provide stimulations, not beyond their capacity. If exposure occurs at the wrong stage of development or at the wrong level of intensity, many of the processes and stimulations required to promote brain development may have negative impacts.⁷ Specific patterns of neuronal activity initiate processes of refinement that serve as the basis for the formation of correct sensory neural networks during critical intervals between the final few months of pregnancy and the first month following birth.¹⁷⁻¹⁹ Given below is the sequence of development (Figure 3).

Description of four important multisensory stimulations to newborns in NICU

The neurodevelopment of preterm newborns is influenced by NICU-related factors. While they are in the hospital, it is essential to understand the type of stimulation, indication, process, and cues of overstimulation to prevent undue complications during stimulation and promote the growth of newborns.

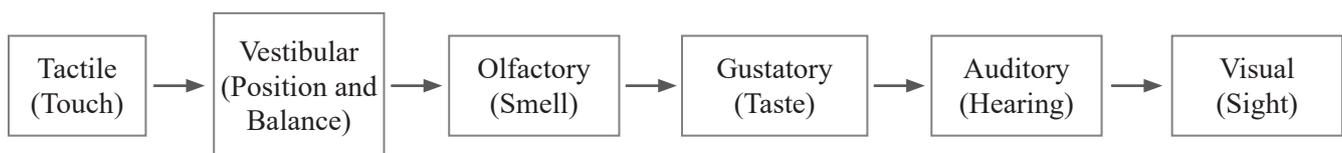


Figure 3: Sequence of development of senses in a newborn

Table 1: Description of auditory, tactile, visual, and vestibular intervention (ATVV) stimulation to the newborn in NICU^{11,15,16,20-23}

Type of stimulation	Indications/contraindications	Procedure	Benefits	Clinical observation for overstimulation
Tactile	<p>Indications:</p> <ul style="list-style-type: none"> - Medically and physiologically stable - 48 hours after birth <p>Contraindications</p> <ul style="list-style-type: none"> • Shouldn't have an incision or fracture • Half an hour after feeding • When the baby is asleep • Active infection or fever/skin disorders/hemophilia or malignancy /apnea or bradycardia • Within 48 hours after immunization 	<ul style="list-style-type: none"> - Hand hygiene - Gentle stroking/massage at the rate of five seconds per stroke for 15 minutes in the following sequence • Infants' head and face-to neck • Neck across the shoulders • Upper back to waist • Thigh to foot and back to the thigh (both legs) • Shoulder to hand and back to shoulder of both arms • KMC may be encouraged 	<ul style="list-style-type: none"> • Weight gain • Decreased length of hospital stay • Reduced stress • Improved neurodevelopmental outcomes • Improved autonomic nervous function • Increased wake/sleep states • Improved bone mineralization • Improved bonding 	<ul style="list-style-type: none"> Pulling away from the stimulus Squirming Crying Inability to settle/get comfortable

Vestibular	Indications <ul style="list-style-type: none"> • Medically and physiologically stable • Based on the gestational age • Appropriate movements 	<ul style="list-style-type: none"> - Provision of water beds or horizontal rocking - Positioning - Slow gentle movements 	Enhance postural stability Gives in-utero experience Maintains balance and equilibrium	Increased motor activity Color changes Crying Poor feeding
Auditory	<ul style="list-style-type: none"> • Sensitive to low-frequency sounds such as speech and language • Loud sounds need to be avoided • Musical toys/ tape recorders can be used in newborns greater than 39 weeks of gestation 	<ul style="list-style-type: none"> - Maternal/caregiver/ health care worker voice/ lullaby 	Promotes active sucking behaviors Promotes physiological stability Promotes sleep Improves motor activity	Observe for changes in color, heart rate, respiratory rate, saturation level Increased motor activity
Visual	<ul style="list-style-type: none"> • Myelination of the optic nerve begins at 24 weeks • Babies < 28 weeks of gestation may still have their eyes sealed shut • No awake visual attention earlier than 30-32 weeks • Strong connections between the visual and tactile systems 	<ul style="list-style-type: none"> - Face-to-face interaction during the awake state - Contrast colors in the nursery 	Improves bonding Provides a multitude of connections with other senses The optic nerve grows and the visual part of the brain develops Improves curiosity, alertness, and attention	Squinting Shading face with hands Turning away

Nurses play an important role in educating the mother or caregiver in initiating sensory stimulation so that individualized care is planned for the newborn in the NICU. Awareness regarding cues of overstimulation can prevent neurodevelopmental complications in newborns. Maternal participation in the care of newborns can reduce stress and strengthen the mother–newborn bond.

Conclusion

Preterm infants and high-risk newborns need extra care to fully develop. Compared to other children, these kids suffer from developmental disorders or delays more frequently, including motor, cognitive, speech, hearing, and vision impairments. An individualized multimodal stimulation program enhances neuromuscular development and is an effective non-pharmacological technique in the development of premature newborns.

Conflicts of Interest

Nil

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