Pain Expression in Preterm Neonates and its Relation to Developmental Care and Serum Cortisol

Thesis

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List of Abbreviations

Abb	Full term
ADHD	Attention-Deficit-Hyperactivity Disorder
ASD	Autism Spectrum Disorder
BP	Blood pressure
dB	Decibel
DYS	Dyspraxia
EEG	Electro-Encephalogram
EMLA	Eutectic mixture of lidocaine and prilocaine
ETT	Endotracheal tube
GA	Gestational Age
GABA	Gamma-Aminobutyric acid
GI	Gastrointestinal
HR	Heart rate
IPPV	Invasive Positive Pressure Ventilation
NICU	Neonatal Intensive Care Unit
NIDCAP	Newborn Individualized developmental care and assessment program
NIPPV	Non Invasive Positive Pressure Ventilation
N-PASS	Neonatal pain, Agitation and Sedation Scale
OGT	Orogastric tube
OTC	Over-The-Counter
PD	Postural Disorder
PG	Prostaglandin
PIPP	Premature Infant Pain Profile
RDS	Respiratory Distress Syndrome
SC	Sensory Craving
SDD	Sensory Discrimination Disorder
SOR	Sensory Over-Responsivity)

List of Abbreviations Cont...

Abb	Full term
SPD	Sensory Processing Disorder
SUR	Sensory Under Responsivity
TGA	Transposition of Great Arteries
WK	Week

INTRODUCTION

Preterm neonates who are admitted in the NICU are frequently exposed to stressful and painful procedures which induce physiological and behavioral neonatal changes ***(Carbajal et al., 2008).***

Stressful and painful procedures include needle pricking, noise, light, cold, infection and mechanical ventilation ***(McNair et al., 2013).***

Some measures called developmental care such as skin to skin contact (kangaroo care), non nutritive suckling, facilitated tucking, reducing light and noise exposure in NICU were found to improve physiological and behavioral pain expression in preterm neonates ***(Coughlin et al., 2009).***

Preterm neonates who received developmental care measures showed better response to pain than neonates who didn't receive developmental care regarding pain expression by following heart rate and oxygen saturation, as well as behavioral cues of the neonate ***(Coughlin et al., 2009).***

Strong relation exists between neonatal pain exposure and serum cortisol level as it's the main stress hormone in humans ***(Gray L et al., 2000).***

Studies revealed that acute exposure to painful procedures associated with elevated serum cortisol while

chronic pain exposure was associated with decreased serum cortisol due to adaptation of the hypothalamic pituitary adrenal axis ***(Dowd, 2009).***

Procedural pain and stress in very preterm infants is associated with abnormal brain development in the NICU because immature neurons are more sensitive to neurotoxic environmental influences ***(Kwok et al., 2014).***

Greater exposure to procedural pain-related stress was associated with reduced development of white matter (indexed by fractional anisotropy (FA) and subcortical gray matter (measured by N-acetylaspartate-to-choline ratio (NAA/choline) a marker of metabolism and density ***(Brummelte et al., 2012).***

AIM OF THE WORK

- **Primary aim**: to study pain expression in preterm neonates and its relation to developmental care and serum cortisol concentration.
- **Secondary aim:** to implement developmental care in NICU of Ain shams university hospitals.

Chapter 1

DEVELOPMENTAL CARE

Definition:

Developmental care is an approach to individualize care of infants to maximize neurological development and reduce long term cognitive and behavioral problems. It includes a variety of measures applied in the neonatal care units to improve the neonatal responses to the different stressors they experience in the NICU and also decrease the developmental impairment that result from these unpleasant stimuli ***(Symington and Pinelli, 2006).***

Why is it important?

Researches done revealed that neonates are exposed to multiple stressful events in the NICU including exposure to bright light, loud noise, heel pricks, venipuncture, suctioning and Orogastric insertions ***(McNair et al., 2013),*** also the normal daily care in the NICU like Bathing, weighing and diaper change perceived as stressful stimuli by neonates ***(Comaru and Miura, 2009; Liaw et al., 2009).***

Developmental care practice was found to counter-balance the detrimental effects of life saving yet stress inducing NICU tasks ***(Marlow et al., 2007).***

Neonates especially preterms exposed to painful procedures in NICU were found liable to develop sensory processing disorders with six subtypes: sensory overresponsivity (SOR), sensory underresponsivity (SUR), sensory craving (SC), postural disorder (PD), dyspraxia (DYS), and sensory discrimination disorder (SDD) ***(Schoen et al., 2017).***

Sensory processing disorders are seen nowadays as a unique and separate diagnosis away from ADHD and ASD although their symptoms may overlap like ADHD and SOR which are characterized by hyperactivity, inattention but not resembling other subtypes of sensory processing disorders ***(Ben-Sasson et al., 2014; Yochman et al., 2013).***

Inappropriate neonatal responses to stress negatively affect neonatal neurodevelopment which is also affected by many factors like gestational age, weight, perinatal sepsis, infections and intracranial hemorrhage which cause finally poor neonatal neurodevelopment ***(White et al., 2013).***

For this aim many researches and studies done to minimize the neonatal stressors themselves and their negative effect on neonatal development showed that applying developmental care measures like minimizing exposure to noise, light, proper skin to skin contact or kangaroo care, proper positioning and applying clustering of care and non nutritive suckling to the preterm neonates decrease neonatal stress and pain ***(Coughlin et al., 2009).***

Goals of developmental care for the infant is to:

- Conserve energy and enhance recovery
- Promote growth and well being
- Protect sleep
- Support emerging behaviours at each stage of neuro-developmental maturation ***(Altimier and Phillips, 2013).***

Goals of developmental care for the family are to:

- Encourage and support parents in the primary caregiver role
- Enhance family emotional and social wellbeing ***(Altimier and Phillips, 2013).***

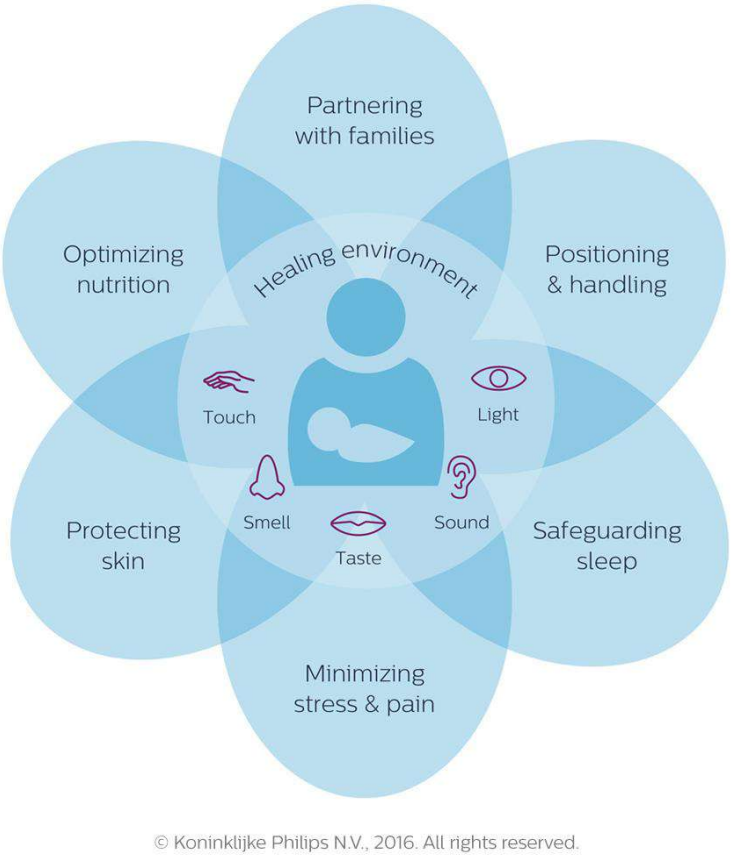

Figure (1): Goals of developmental care ***(Altimier and Phillips, 2013).***

Developmental care measures:

Minimizing noise exposure helps proper neonatal neurodevelopment as Preterm neonates experience many noisy stimuli in Neonatal intensive care units like alarms, CPAP, Ventilators, infusion pumps, loud sounds ***(John Hopkins, 2006).***

The maximal limit of noise exposure should not exceed 45 dB and this is very difficult to be controlled, even simple