Oxytocin and Cortisol Release is Associated With Premature Infant Neurobehavioral Patterns

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Background/Significance

It has been optimistically, yet incorrectly, proposed that healthy preterm infants without major complications eventually catch up developmentally to term infants. Parental touch, especially during skin-to-skin contact (SSC) has the potential to reduce adverse consequences of prematurity. Oxytocin is a neuropeptide that stimulates bonding and parenting behaviors by a bio-behavioral feedback loop. Mothers and fathers with increased oxytocin levels have more reciprocity and synchronicity in their interactions with their infants. Evidence suggests that neurobiologically, oxytocin directs the young infant to preferentially select species-specific social stimuli to form dyadic attachments. Oxytocin is considered critical in the experience-dependent plasticity underpinning auto-regulated functioning in response to experiences during sensitive periods of development.

Aims

The purpose of this research study was to examine salivary oxytocin and cortisol levels related to skin-to-skin contact (SSC) to demonstrate better infant neurobehavioral functioning using the Neonatal Network Neurobehavioral Scale (NNNS).

Methods

A randomized cross-over design study was conducted in the Neonatal Intensive Care Unit (NICU). Infant saliva samples for oxytocin and cortisol were collected pre-SSC, 60-min during-SSC, and 45-min post-SSC. Infant neurobehavioral assessment using NNNS was collected prior to hospital discharge. Data were analyzed using R version 4,0,3. Linear regression models included four predictor variables: salivary oxytocin and cortisol levels after SSC; two measurements for each based on whether the infant was held by the mother or by the father.

Results

A significant inverse relationship was found for infants who were held SSC, with their mothers demonstrating higher oxytocin levels and lower Stress summary scores ($t= -3.48$, $p<.003$). For these same infants, a significant relationship with higher self-regulatory summary scores ($t=2.104$, $p<.049$) was also found. Interestingly, infants held SSC by mothers that demonstrated higher cortisol levels also demonstrated higher Asymmetrical Reflexes summary scores ($t=2.413$, $p<.026$). We found that infants held by mothers demonstrating higher cortisol levels ($t=2.249$, $p<.037$) also demonstrated similarly high levels with fathers ($t=2.156$, $p<.044$) that were also associated with higher infant Stress summary scores. There were no significant differences noted between our data and the published normative NNNS summary score values identified in Figure 1 (Lester et al., 2004) for the preterm subset despite mean gestational age (36 1/7) being younger corrected post-menstrual age for participants in the current study at the time of hospital discharge. Lester and colleagues reported NNNS exams completed at post-menstrual age 42-44 weeks.

Relevance to NIDCAP

This research explores the bio-behavioral mechanisms that modulate high-risk infants' behavioral, autonomic, and stress responses utilizing an individualized developmental family-centered care approach. Skin-to-skin contact is an evidenced-based holding strategy that increases parental proximity to their infant. This physical proximity allows for a continuously interactive environment that is known to enhance infant physiologic stability and affective closeness between parent and infant. Uncovering the neurobiological basis of early parent-infant interaction is an important step in developing therapeutic modalities to increase parent engagement and improve health outcomes.

Conclusions

These findings are an important step in exploring oxytocin as an important biomarker that provides evidence that demonstrates potential improvement in infant neurodevelopmental functioning and competence. The organization of oxytocin availability is critical to the limbic and neocortical systems, and those nervous system structures related to emotion depend on early caregiving experiences. SSC is an intervention that increases oxytocin and decreases cortisol. Nurses can use SSC as a strategy to activate oxytocin release to enhance infant neurodevelopmental outcomes. Additionally, these findings provide further evidence that neurobehavioral assessments can and should be incorporated into the care of preterm infants to identify an individualized plan of care to support the unique strengths of the infant's current level of behavioral functioning.

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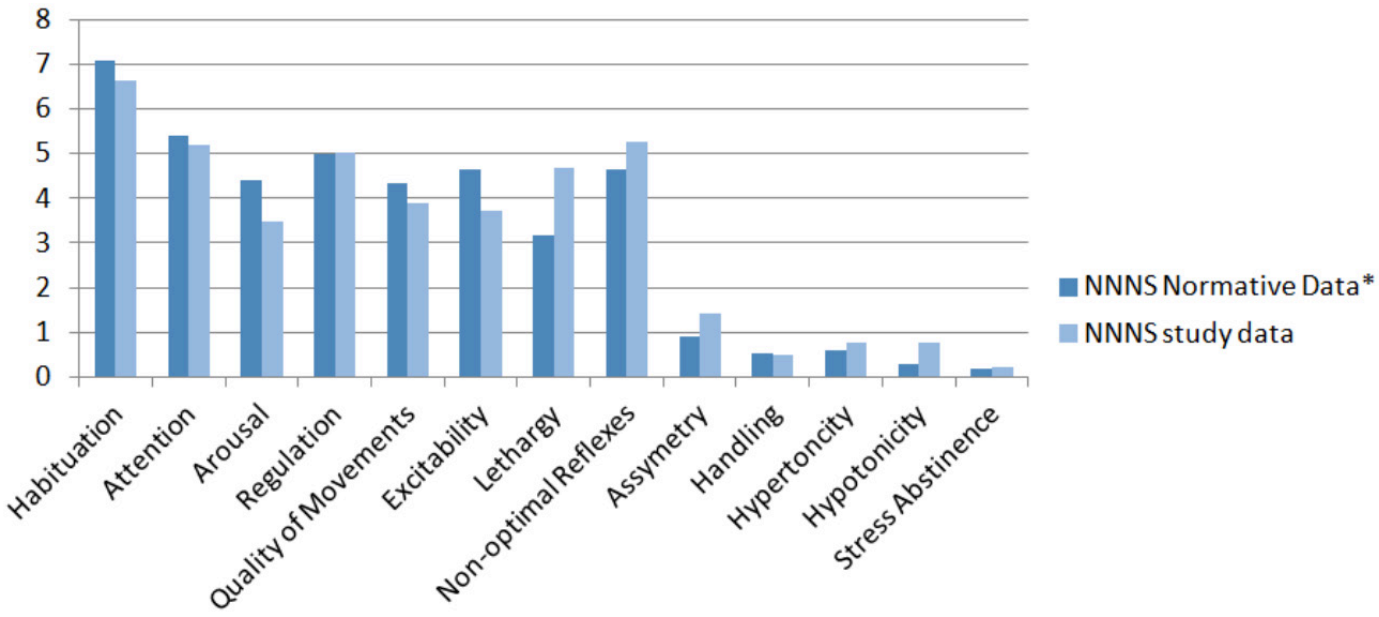
Figure 1. Neonatal Network Neurobehavioural Scores



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