



Kangaroo–mother care method and neurobehavior of preterm infants[☆]



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ABSTRACT

Objective: To evaluate the effect of kangaroo–mother care (KMC) in preterm (PT) neurobehavior between 36 and 41 weeks post-conceptual age (PCA).

Method: A prospective cohort of 61 preterm infants with gestational age (GA) of 28–32 w evaluated by the Neonatal Intensive Care Unit Network Neurobehavioral Scale (NNS), with 36–41 w PCA. Infants with clinical instability were excluded. They were analyzed in 2 groups: – Kangaroo (KAN): KMC for 7 or more days; Conventional (CON): did not receive KMC. Scores of the 13 NNS variables were compared between groups and the effect of KMC in the scores of the variables of NNS were evaluated by multiple linear regression, controlling for confounders.

Results: The KAN groups (n = 24) and CON (n = 37) were similar regarding main demographic and clinical maternal and neonatal characteristics. Mean GA was 30.3 w; and birth weight was 1170 g for both groups. PT of KAN group were admitted in KMC with PCA of 35.8 w (38.5 days of life) and remained with this care for 14.3 days. The NNS was applied 13 days after the start of KMC. PT submitted to KMC showed higher quality of movements (KAN: 4.98 ± 0.53 vs CON: 4.53 ± 0.47 ; $p = 0.001$) and lower scores on Signs of stress and abstinence (KAN: 0.03 ± 0.03 vs CON: 0.05 ± 0.03 ; $p = 0.001$). Controlling for confounders, the KMC was associated with higher scores on the variables Attention, Quality of movements, and lower scores on Asymmetry and Signs of stress and abstinence.

Conclusion: PT submitted to the KMC, compared to those non-submitted, have better neurobehavior performance between 36 and 41 weeks of post-conceptual age.

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1. Introduction

Prematurity is a major concern in public health. In 2010, about 15 million of preterm infants were born worldwide [1]. In Brazil, prematurity rates have risen over the years, representing 11.5% of births in 2013 [2]. Preterm infants remain hospitalized for long periods in the Neonatal Intensive Care Unit (NICU), where they are exposed to noxious environmental stimuli [3,4]. The experiences in the NICU and the clinical complications related to prematurity are associated with negative outcomes in their neurologic development during childhood, such as cerebral palsy, cognitive impairment, hearing and visual impairment, learning difficulties and behavioral problems [5].

Several measures have been adopted to promote a better neurodevelopment of preterm infants, with emphasis on a more humanized care with the participation of the family in the NICU [6]. One of these measures is the skin-to-skin contact between the baby and his

mother/father that promotes a multi-sensory stimulation that inhibits the perception of pain and stress of the newborn [7,8]. Skin-to-skin contact promotes better organization of motor and physiological systems, resulting increased weight gain, fewer infections and mortality [9], better thermal stabilization [9], and behavioral effects that include shorter duration of crying and fewer signs of stress and pain [10]. Long-term effects have also been reported, such as better motor and cognitive performance and a more intense family interaction [11]. In view of these results, the kangaroo mother care has been recommended as a practice that can contribute to improve development of preterm infants [12]. In Brazil, Ministry of Health guidelines [13] recommend that skin-to-skin contact between mother and baby starts soon after birth. Next to the discharge, whenever possible, mothers are hospitalized again and remain 24 h a day with their infants. During this period, in addition to performing skin contact (kangaroo position), mothers are responsible for the whole care of their infants, promoting greater empowerment and maternal safety and better competence of the baby, encouraging breastfeeding and favors the mother–baby bond.

The neonatal behavior is influenced by infants' experiences and their interaction with the environment and with their caregivers [14]. In 2004, Lester and Tronick published the NICU Network Neurobehavioral

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Scale (NNS) [15] to evaluate the neurobehavior of newborn infants at risk. Studies have shown an association between neonatal behavior and neurodevelopment in infancy [16]. There are few studies to assess the effects of kangaroo care method on the behavior of preterm neonates. The objective of this study is to evaluate the effect of kangaroo care method (continuous contact between mother and infant) for at least 7 days in neurobehavioral responses of infants with gestational age between 28 and 32 weeks, evaluated between 36 and 41 weeks post-conceptual age, compared to those receiving conventional care.

2. Method

This is a prospective cohort of preterm infants with gestational age between 28 and 32 weeks admitted to the Intensive Care Unit of the Assis Chateaubriand Maternity School, a university tertiary maternity hospital in Fortaleza, Ceará, Northeast Brazil, from March 2012 to December 2014. The study was approved by the Research Ethics Committee of the Maternity, under the number 188/11, and by the Federal University of São Paulo Institutional Review Board, with the number 1755/11.

All infants born with gestational age between 28 and 32 weeks were included after obtaining the written maternal informed consent. The infants who died or those with neurological disorders, congenital infections, malformations, genetic syndromes and clinical instability were excluded. Clinical instability was defined as need of incubator and respiratory and/or hemodynamic support. Infants without maternal informed consent, that were transferred or discharged before 36 post-conceptual weeks were not evaluated.

Demographic and clinical characteristics were collected. The presence of maternal depression was evaluated by the Edinburgh Postnatal Depression Scale (EPDS) [17]. For the diagnosis of depression, the cut-off score of 13 showed a sensitivity of 84% and a specificity of 75% in the validation study of the scale in Brazil, with women in the postpartum period [18].

Data on neonatal birth conditions and the clinical course during hospital stay were collected. The clinical severity of the newborn in the first 24 h of life was assessed by the Score for Neonatal Acute Physiology Perinatal Extension-II (SNAPPE II) [19]. After clinical stabilization, the severity of clinical condition was assessed by the Neonatal Therapeutic Intervention Scoring System (NTISS) [20].

At 32 post-conceptual weeks, the mother–infant bonding was assessed, by the Mother-to-Infant Bonding Scale (MIBS) [21]. Scores range from zero to 24, with higher scores indicating disorders in the interaction. In a study of mothers assessed 48 h after delivery, MIBS showed a sensitivity of 90% and a specificity of 80% to identify inappropriate mother–baby bonding if scores ≥ 2 [22].

After discharge from NICU, the preterm infants were admitted to the Conventional Intermediate Care Unit, where they could stay until hospital discharge. According to maternal desire and availability to remain in hospital with her infant 24 h a day, the pair could be transferred to the Kangaroo Intermediate Care Unit, whenever free beds were available. Therefore, two groups were formed: the Kangaroo (KAN) Group and the Conventional (CON) Group. To be included in the Kangaroo Group, the newborn had to have remained at least seven days in the Kangaroo Intermediate Care Unit, where the mother (readmitted in the hospital) stays full time with her child, being responsible for the nutrition and care of the infant, with frequent skin-to-skin contact. The Conventional Group was composed of preterm infants who remained in the Conventional Intermediate Care Unit until hospital discharge, where care was conducted by the nursing team, with free parental visits and kangaroo positioning five times a week for around 60 min, during visits. Neonates that remained less than seven days in the Kangaroo Intermediate Care Unit were excluded from the study.

The neurobehavioral assessment was carried out between 36 and 41 weeks and 6 days of post-conceptual age with the Neonatal Intensive Care Unit Network Neurobehavioral Scale (NNS) [15]. All evaluations

were performed by a researcher (MGCS) trained by a professional previously trained by the authors of the scale (MCMB), as recommended by Lester and Tronick [23]. For neurobehavioral exam, a kit containing flashlight, red ball, red rattle, bell and plastic device for heel spur was used. After application of the scale, each item was scored as that of Lester and Tronick [15]. The items were grouped into 13 variables, according to Boukydis et al. [24]: habituation, attention, arousal, control, maneuvers to orientation, quality of movements, excitability, lethargy, reflexes with non-optimal responses, asymmetry, hypertonicity, hypotonicity, and signs of stress and abstinence.

For comparing the scores of the 13 variables of NNS between groups, *t*-test was used. For assessing the effect of kangaroo care method in neurobehavioral responses of preterm infants, variables possibly associated with the variance of the scores of the 13 variables of NNS were analyzed by univariate linear regression. The independent variables studied were: KAN group, maternal age (years), schooling (years), having a previous child, EPDS score, MIBS score, sex, gestational age (weeks), small for gestational age, SNAPPE-II score, NTISS score, length of stay in the Neonatal Intensive Care Unit before kangaroo care or conventional care (days), post-conceptual age (weeks) and post-natal age (days) at the time of neurobehavioral evaluation, and time between last feeding and the exam (minutes). Afterwards, for each one of the 13 NNS variables, a multivariate linear regression model was built, considering as independent factors KAN group as well as all variables with statistical significance ($p < 0.20$) detected in the univariate regression analysis.

The sample size was calculated considering a difference of 0.7 points on scores [25] of NNS variables between groups, with a standard deviation of 0.8 [25], alpha risk of 5% and sample power of 80%. The need of 20 newborn infants per group was estimated. Statistical analysis was performed with SPSS for Win/v.20.0 (Chicago, IL, USA).

3. Results

During the study period, 190 newborns with gestational age between 28 and 32 weeks were born. Of these, 129 were not studied (Fig. 1) and 61 newborns were included, 24 in the Kangaroo Group and 37 in the Conventional Group (Fig. 1).

The maternal sociodemographic and clinical characteristics of the 61 studied infants and the 76 non-included (18 transferred to another hospital, 17 without consent, 10 not assessed, 10 that stayed less than 7 days at KMC and 21 that have hospital discharge of less than 36 weeks of post-conceptual age) were similar except that the mothers of the non-included group had a higher number of gestations (2.48 ± 1.80 vs 1.77 ± 1.15 ; $p = 0.009$) than the mothers included. Regarding the neonatal characteristics, both groups have similar gestational age (30.3 ± 1.2 vs 30.3 ± 1.1 ; $p = 0.944$), non-included babies were heavier (1304 ± 240 vs 1170 ± 203 g; $p = 0.001$), the frequency of small for gestational age was lower (5.6% vs 29.5%; $p < 0.001$) and they had a lower SNAPPE score (9.56 ± 7.99 vs 12.8 ± 9.47 ; $p = 0.035$).

Maternal characteristics of the study groups are shown in Table 1. Table 2 presents the characteristics of newborns of the KAN and CON groups. The use of invasive mechanical ventilation was similar between groups [KAN: 18 (75.0%); CON: 32 (86.5%); $p = 0.315$], as were the days on mechanical ventilation [KAN: 6.1 ± 4.8 ; CON: 8.8 ± 8.7 days; $p = 0.218$].

Newborns of Kangaroo Group were discharged 10 days earlier [KAN: 53.7 ± 9.0 ; CON: 63.6 ± 17.5 days; $p = 0.014$], with a younger post-conceptual age [KAN: 37.9 ± 1.1 ; CON: 39.3 ± 1.7 weeks; $p = 0.001$], but no difference was observed in the weight at discharge [KAN: 2153 ± 331 ; CON: 2348 ± 435 g; $p = 0.068$]. At the time of hospital discharge, the frequency of exclusive breastfeeding was higher among Kangaroo Group (KAN: 70.8 vs CON: 43.2%; $p = 0.040$).

The 24 neonates of Kangaroo Group were admitted to the Kangaroo Intermediate Care Unit with a post-conceptual age of 35.8 ± 1.1 weeks and a post-natal age of 38.5 ± 7.8 days, and they remained $14.3 \pm$

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