Effect of kangaroo mother care on cerebral hemodynamics in preterm infants

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Abstract

Background: Kangaroo mother care (KMC) has been widely used to improve the care of preterms and low birth weight infants. This study was conducted to evaluate the effect of KMC on cerebral blood flow in preterm infants.

Materials & methods: A total of 40 subjects were enrolled. A pre-post test without a control group study was included. CBF flow parameters were measured with Doppler ultrasonography in one middle cerebral artery. Other variables heart rate and mean arterial blood pressure were also studied before and after KMC. P- value less than 0.05 was considered significant.

Results: Comparing data before and after the application of KMC for 30 minutes, there has been a significant decrease in heart rate and an increase in systolic and diastolic blood pressure, MABP.

Conclusion: Kangaroo mother care improves cerebral blood flow in stable preterm infants.

Keywords: Cerebral blood flow, Infants, Kangaroo mother care.

Introduction

In developing countries, around 21% of infant mortality is caused by perinatal conditions. Most of the causes of neonatal death can be prevented or treated through simple, effective and low-cost intervention, at home or in the community. [1] Premature infants in the intensive care environment are exposed to an abnormal environment, repeated invasive procedures and prolonged illness. They are highly susceptible to develop various cerebral lesions like intraventricular hemorrhage or periventricular leukomalacia following cerebral hypoperfusion because of their immature brains. This intense sensory impacts neuro-development and long-term outcomes of the premature infants. [2,3]

Kangaroo mother care (KMC) consists of a four-part practice which includes holding a diaper-clad infant skin-to-skin and prone on the bare chest of their primary caregiver as soon as possible after birth, exclusive breastfeeding where possible, and early discharge from the health-care unit with close monitoring and support at home. [4] KMC was first used as a developmental care method in the late 1970s by Dr. Rey and Dr. Martinez in Bogota, Colombia, where the use of incubators for traditional care of the infants was either not available and/or unsafe. [5] KMC is used worldwide for term and preterm infants, and there is an extensive literature supporting its safe use with stable infants whether premature or full-term. [5-8] The primary purpose of KMC is to meet the infants' biological needs for warmth, nutrition, and love, and it has been repeatedly shown to decrease mortality, enhance breastfeeding, and decrease the risk of morbidities such as hypothermia, hypoglycemia, neonatal sepsis, and readmission to the hospital.[5]

Certain aspects of the physiology of stable preterm babies have been shown to be enhanced by KMC, thereby positively influencing their short- and long-term health outcomes. A recent Cochrane meta-analysis of randomized controlled trials compared KMC and conventional neonatal care of preterm infants and showed a reduction in the risk of mortality, severe nosocomial (hospital-acquired) infection/sepsis, hypothermia, respiratory tract disease, and lengthy hospital stays, as well as improvements in some measures of infant growth and breastfeeding. [9] Hence, this study was conducted to evaluate the effect of KMC on cerebral blood flow in preterm infants.

Materials & methods

A total of 40 subjects were enrolled. A pre-post test without a control group study was included. CBF flow parameters were measured with Doppler ultrasonography in one middle cerebral artery. The preterm stable infants were assessed before and after 30 min KMC. CBF indices were assessed in different positions before KMC, 20 neonates in supine position and 20 in vertical suspension. Other variables heart rate and mean arterial blood pressure were also studied before and after KMC. The data was collected and results were analysed using SPSS software. P-value less than 0.05 was considered significant.

Results

A total of 40 subjects were enrolled. Comparing data before and after the application of KMC for 30 minutes, there has been a significant decrease in heart rate and an increase in systolic and diastolic blood pressure, MABP.

Table 1: Comparison between vital signs before and after 30 min of KMC

Variables	Before KMC	After KMC	p- value
HR(b/min)	152	148	0.01*
SBP (mmHg)	72	74	0.01*
DBP (mmHg)	31	32	0.01*
MABP	45	46	0.01*

*: significant
HR: Heart rate, SBP: Systolic blood pressure, DBP: Diastolic blood pressure.
MABP: Mean Arterial Blood Pressure.

Regarding CBF parameters, there has been a statistically significant decrease in PI after 30 min of KMC and increase in the mean velocity (MV).

Table 2: Comparison between CBF indices before and after 30 min KMC

Variables	Before KMC Mean	After KMC Mean	p- value
P.I	2.05	1.89	0.01*
MV	28.12	34.25	0.01*

*: significant
PI: Pulsatility index
MV: Mean velocity.

No significant difference (P >0.05) in CBF parameters between supine and vertical positions before KMC. Patients who received the KMC in the supine position evidenced a significant decrease in PI at the end of the 30 minutes.

Table 3: CBF parameters in different position (Supine &vertical) before KMC

	Supine Mean	Vertical Mean	p- value
P.I	2.12	1.98	0.06
MV	26.15	26.13	0.06

Table 4: CBF parameters in supine position before KMC and 30 min after KMC

	Supine before KMC Mean	30min KMC Mean	p-value
P.I	2.12	2.02	0.04*
MV	26.15	33.52	0.02

Discussion

Premature infants have significantly more developmental impairment than their term counterparts. Oxygen is regularly used in preterm infants because of their immature lungs and oxygen is important for metabolism and physiological functions. [10,11] Researchers have explained the improvement in oxygenation by the fact that the upright position of KMC increases the efficiency of the diaphragm and pulmonary function. [12] On other hand, other researchers have concluded no significant changes in oxygen saturation and consumption during KMC. [13] Hence, this study was conducted to evaluate the effect of KMC on cerebral blood flow in preterm infants.

In the present study, a total of 40 subjects were enrolled. Comparing data before and after the application of KMC for 30 minutes, there has been a significant decrease in heart rate and an increase in systolic and diastolic blood pressure, MABP. A study by Korraa AA et al, the mean gestational age of the infants was (32 ± 2 weeks), and mean birth weight was (2080 ± 270 gm). Comparing CBF indices (Pulsatility index and Resistive index) before and after KMC has shown a significant decrease in both Pulsatility index (PI) and Resistive index (RI) after 30 min. KMC, the mean values were (2.0 ± 0.43 vs 1.68 ± 0.33 & 0.81 ± 0.05 vs 0.76 ± 0.06 respectively $P < 0.05$*) with mean difference (0.32 & 95% CI 0.042-0.41 & 0.05 & 95% CI 0.04 to 0.06 respectively $P < 0.05$*) and increase in end diastolic velocity & mean velocity 30 min of KMC (10.97 ± 4.63 vs. 15.39 ± 5.66 $P < 0.05$*& 25.66 ± 10.74 vs. 32.86 ± 11.47 $P < 0.05$*) with mean difference (−4.42 & 95% CI −5.67 to −3.18 and −7.21 & 95% CI -9.41 to 5.00 respectively). These changes indicate improvement in CBF. No correlation has been found between CBF parameters and studied vital signs or SpO2. [14]

In the present study, regarding CBF parameters, there has been a statistically significant decrease in PI after 30 min of KMC and increase in the mean velocity (MV). No significant difference (P >0.05) in CBF

parameters between supine and vertical positions before KMC. Patients who received the KMC in the supine position evidenced a significant decrease in PI at the end of the 30 minutes. Another study by Chaudhari AJ et al, 40 enrolled neonates (24 males), the mean (SD) birth weight, gestation age, and postnatal age were 1698.25 (495.44) g, 33.00 (1.67) wk, and 6.80 (4.51) days, respectively. The mean (SD) cerebral blood flow velocities increased (peak systolic velocity (PSV), P=0.03; end diastolic velocity, P<0.001; mean velocity, P<0.001) and doppler indices decreased (resistive index, P=0.001; pulsatility index, P<0.001) significantly; whereas, heart rate (P<0.001) decreased but SpO2 (P=0.001) and mean blood pressure (P=0.003) increased significantly at 60 minutes of KMC as compared to baseline. Sixty minutes after stopping KMC, all parameters (except PSV) were higher than baseline, indicating post KMC effect. [15] It is noteworthy that two distinct patterns of KMC for premature babies have emerged: first, continuous kangaroo mother care (c-KMC), which is most prevalent in low-income and poorly resourced settings, and second, intermittent kangaroo mother care (i-KMC), which is more common in affluent hi-tech settings. The World Health Organization issued practical guidelines in 2003 for KMC in both settings, suggesting urgency of application based on increasing and compelling evidence that KMC decreased mortality and morbidity associated with premature birth while enhancing breastfeeding and some psychosocial indices. Following this, meta-analyses have produced further support for the recommendation of KMC upscaling in all income settings, including middle- and high-income countries. [5,6] Regarding blood pressure, head up tilt may cause a fast-acting vestibular-mediated increase in BP. Subsequently, a stimulated baroreflex causes falling in HR and BP returns to resting levels. Other studies haven't shown any significant changes in blood pressure before and after KMC. [16,17]

Conclusion

Kangaroo mother care improves cerebral blood flow, and promote development of the premature infant's brain.

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