Original Article

Effect of Kangaroo Mother Care on the breastfeeding, morbidity, and mortality of very low birth weight neonates: A prospective observational study

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ABSTRACT

Objective: To compare the effect of Kangaroo Mother Care (KMC) versus conventional mother care (CMC) on growth, morbidity, mortality, and length of hospitalization in very low birth weight (VLBW) neonates. **Study Design:** A hospital based prospective observational study conducted in the pediatric department of a tertiary care teaching hospital in Southern Odisha. **Materials and Methods:** A total of 100 VLBW neonates were included. The effect of KMC on growth, morbidity, breastfeeding, and length of hospitalization was studied. The KMC group (n=50) was subjected to KMC for at least 6 h/day. The neonates received kangaroo care during hospitalization and at home. The control group (n=50) received CMC. **Results:** The KMC babies had better average weight gain per day (15.9±4.5 vs. 10.6±4.5 g, p<0.0001). The weekly increments in head circumference (0.75 vs. 0.49 cm, p=0.001), length (0.99 vs. 0.7 cm, p=0.021), and chest circumference (0.73 vs. 0.45 cm, p=0.004) were higher in the KMC group. Significantly more neonates receiving CMC suffered from hypothermia (36% vs. 6%), apnea (16% vs. 2%), and other minor illnesses (44% vs. 16%) than those receiving KMC. There was earlier hospital discharge in KMC group (6 vs. 18 days). More neonates of KMC group were exclusively breastfed at the end of the study (86% vs. 42%). No mortality was noted in either group. **Conclusions:** KMC improves growth, reduces morbidities, improves breastfeeding rates, and reduces hospitalization in VLBW neonates.

Key words: *Conventional mother care, Breastfeeding, Morbidity, Kangaroo Mother Care, Very low birth weight*

Kangaroo mother care (KMC) is continued skin to skin contact between the mother or caregiver and the neonate which has been recognized as an effective method to provide thermal care and promote breastfeeding. The prevalence of low birth weight (LBW) neonates is around 16% globally and 28% in South Asia (including India) as per the UNICEF [1]. Most (48%) of the neonatal deaths are related to prematurity and very low birth weight (VLBW) [1,2]. There are limited financial resources for infrastructure and manpower needed for the care of all such babies in developing countries like India. As regards to keeping a VLBW neonate warm, Kangaroo Mother Care (KMC) is a cost effective alternative to costly incubator/warmer care in these settings [3,4].

Studies have found that besides promotion of euthermia and breastfeeding in VLBW neonates, KMC has many additional advantages that include but not limited to facilitation of mother to child bonding, improved growth and neurodevelopment behavior, decreased neonatal morbidity and mortality as well as earlier hospital discharge or discharge from the Neonatal Intensive Care Unit [5-8]. Besides the mother, any other family member including the father can do KMC as Indian mothers are busy doing household work most of the time.

The state of Odisha has one of the highest numbers of premature deliveries including LBW and VLBW neonates as well as a high neonatal mortality rate in India. Being a low cost intervention, KMC has the potential for wider applicability and acceptability in resource poor setting in improving various outcomes in VLBW neonates. As there is no previous published data from this part of the country, this study was designed to study the usefulness of KMC on various outcomes of VLBW neonates. We planned to study the effect of KMC on morbidity, breastfeeding, weight gain, and hospital stay of VLBW neonates (1000-1500 g).

MATERIALS AND METHODS

This prospective hospital based observational study was conducted in the Special Newborn Care Unit (SNCU), and Pediatric Outpatient Department of MKCG Medical College and Hospital, Berhampur, Odisha, India over 24 months period (from December 2013 to November 2015). The care provided in SNCU includes Level II neonatal care with facility for administration of oxygen via various non-invasive devices, temperature maintenance via open care system, continuous

positive airway pressure, and surfactant administration. Ethics Committee clearance was taken before starting the study. After taking consent from the parents, hemodynamically stable VLBW (1000-1499 g) neonates, both inborn and outborn, were included in the study. Extremely LBW (<1000 g), newborn with birth weight (>1500 g), with congenital malformations or chromosomal abnormality, and those who died within 72 h of enrollment were excluded from the study. Recruited neonates were then divided into following two groups (Figure 1).

The Case (KMC) Group

It comprises 60 neonates whose mothers/parents were ready to provide kangaroo care. The eligible neonates were shifted to KMC ward where KMC was done under the supervision of trained nurses and residents on duty. Neonates were positioned between the mother breasts in an upright position dressed properly with a cap, socks/mitten and diaper, and were given skin-to-skin contact. Mothers were advised to wear front open gowns, and were provided with comfortable chairs and beds. Mothers were advised to continue KMC as long as possible but not <8 h/day. Paladai/katori-spoon feeding of expressed breast milk or preterm formula was provided 2 hourly. The neonates were monitored clinically as well as through vital sign monitors. The unit protocol for discharge from hospital or discontinuation of KMC was followed. After discharge, advice was given to continue KMC at home with involvement of family members if required.

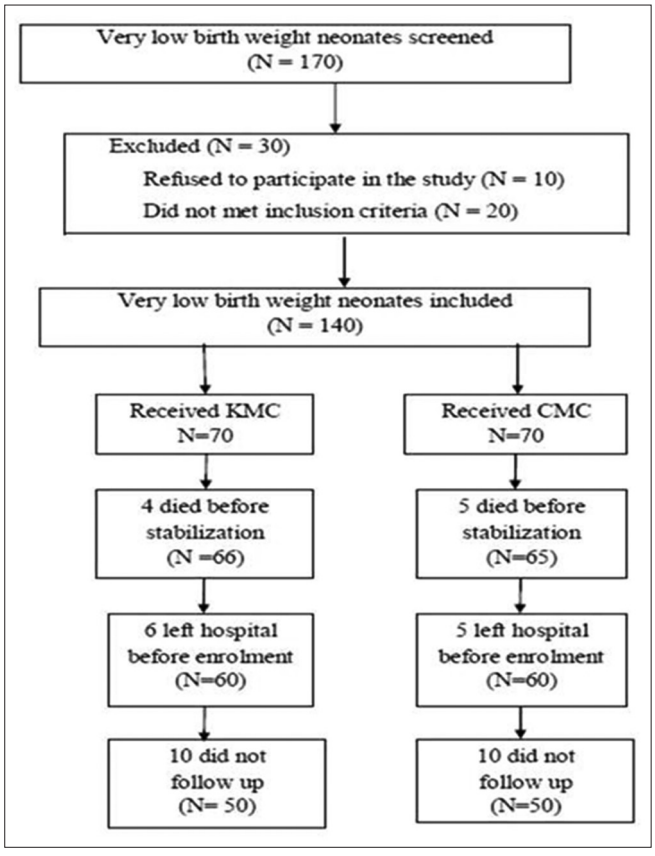

Figure 1: Flow chart of group allocation

The Control or Conventional Mother Care (CMC) Group

It included 60 age and sex matched VLBW neonates whose mothers were not practicing KMC, and were mostly delivered at home. Mothers were advised to provide usual standard care (diaper/nappy change, massage with oil, paladai/katori-spoon feeding of expressed breast milk or preterm formula 2 hourly). The temperature was maintained in the euthermic range by the servo mode. The neonates were monitored clinically as well as through vital sign monitors. The unit protocol for discharge from hospital or discontinuation of KMC was followed. After dropout of 10 cases in each group, 50 cases per each of KMC and CMC group were followed up till end of the study (Figure 1).

Primary objectives were to compare the growth rate (weight gain, and gain in length, head and chest circumference) and breastfeeding rate (exclusive breastfeeding rate at 40 weeks post-conceptional age) in both the groups. Secondary objectives were to assess the occurrence of various morbidities (hypothermia, apnea, and other minor illness), hospitalization (time from birth to discharge), and mortality.

An electronic weighing scale was used to record daily weight with a variability of 5 g. A non-stretchable tape was used to measure the occipitofrontal (head) circumference and recorded in centimeters. An infantometer was used to record the length to the nearest 0.1 cm. Apnea was defined as the cessation of respiration for >20, or <20 s in the presence of cyanosis or bradycardia. Hypothermia was defined as an axillary temperature of <36.5°C. Gestational age assessment was done as per the New Ballard score.

Following data were collected: Detailed maternal history, socioeconomic status (modified Kuppuswamy scale), birth events, sex of the baby, weight of the baby, head circumference, chest circumference, length, hospital stay, any major illness, and any minor illness were recorded on the prerecorded performance. Thorough general examination and systemic examination were done for all the neonates included in the study. Continuation of KMC at home was ensured through telephonic follow-up. Follow-up was done till 40 weeks post-conceptional age or attainment of birth weight of 2,500 g (whichever earlier).

Statistical analysis was performed with GraphPad prism version 5 software. Continuous date was computed as mean plus or minus standard deviation. Student's unpaired t-test was applied for comparison of means. Chi-square tests were performed to compare categorical variables. Statistical significance was set at $p<0.05$.

RESULTS

The baseline characteristics of included neonates have been presented in Table 1. Baseline neonatal characteristic was statistically nearly similar except for the birth weight which was higher in KMC group. In KMC group, 37 (61.7%) neonates were delivered normally, 16 (26.7%) were delivered by cesarean section, and 7 (11.6%) had instrumental delivery. In the CMC group, 36 (60%) had normal delivery, 24 (40%) neonates were delivered by cesarean section, and none had instrumental delivery. Incidence of cesarean section and instrumental delivery

was significantly more in KMC group (60%) compared to CMC group (40%). All the study population was comprised, preterm neonates. In the KMC group, 41 (68.3%) were born to primigravida, and 19 (31.7%) were born to multigravida mothers. In the CMC group, 38 (63.3%) were born to primigravida, and 22 (36.7%) were born to multigravida mothers.

The baseline characteristics of mother of two groups were comparable: Education of mother <10th class was 24% in KMC group and 72% in CMC group, and >10th class 76% in KMC group and 28% in CMC group. Maternal age between 18 and 25 years of age was 52% in KMC group and 48% in CMC group. Maternal age between 26 and 35 years was 44% in KMC group and 52% in CMC group. Around 4% of the mothers were >35 years age in KMC group and none in CMC group.

A total of 20 neonates did not turn for follow-up (10 in each group), so final outcome analysis was performed on 100 neonates (50 each). The effect of KMC on various neonatal outcome parameters has been presented in Table 2. Average weight gain per day (15.9±4.5 vs. 10.6±4.5 g, p<0.0001), weekly increments in head circumference (0.75 vs. 0.49 cm, p=0.001), length (0.99 vs. 0.7 cm, p=0.021), and chest circumference (0.73 vs. 0.45 cm, p=0.004) were significantly higher in KMC group than the CMC group. Morbidities were higher in CMC group, and significantly more neonates receiving CMC suffered from hypothermia (36% vs. 6%), apnea (16% vs. 2%), and other minor illnesses (44% vs. 16%) than those receiving KMC. Average duration of hospital stay in KMC group was 6 days as compared to 18 days in CMC group. No mortality occurred in both the groups. Increase in exclusive breastfeeding rate occurred in 86% in KMC group and 42% in CMC group.

Table 1: Baseline neonatal characteristics

Characteristics	KMC (n=60)	CMC (n=60)
Male sex*	31	32
Gestational age (weeks)	32.32±2.5	32.74±2.71
Birth weight (g)	1288.6±118.7	1262.28±121.55
Length at birth	40.76±1.56	40.36±1.43
Head circumference at birth	27.6±1.18	27.72±1.65
Chest circumference at birth	24.52±1.49	24.88±2.29
Number of inborn neonates*	37	40

All parameters are expressed in mean±SD, *Expressed in proportions. KMC: Kangaroo mother care, and CMC: Conventional mother care

DISCUSSION

In this study, babies receiving KMC had a better daily weight gain as compared to those receiving CMC (15.9±4.5 vs. 10.6±4.5 g, p<0.0001). This finding is comparable to the results of other studies [5,9]. In a study by Ramanathan et al., neonates in KMC group demonstrated better weight gain after the 1st week of life (15.9±4.5 vs. 10.6±4.5 g/day, p<0.05) [5]. In another study, neonates in KMC group had better average weight gain per day (23.99 vs. 15.58 g, p<0.001) [9]. Various studies showed that KMC is helpful in preventing hypothermia in LBW neonates [9-11]. In our study also, occurrence of hypothermia was significantly lesser in KMC group (6% vs. 36%, p=0.003). One study showed the lesser incidence of hypothermia in KMC as compared to CMC group (5.9% vs. 36.9%) [9]. Another study showed similar results (22.7% vs. 46.7%, p<0.01) [11]. The hypothermia incidence also is significantly less when compared post-KMC to pre-KMC [12].

Regarding the development of apnea, in this study, 2% of neonates in KMC group developed apnea, but in CMC group 16% neonates developed apnea (P=0.034). It was comparable with a previous study which showed that babies given KMC had less morbidity like apnea [13]. Similarly, another prospective study found no episode of apnea during KMC [4]. In our study, average duration of hospital stay was longer in CMC (14-18 days) than the KMC group (6-8 days) (p=0.038). Ramanathan et al. showed that there was earlier hospital discharge in KMC group (27.2±7 vs. 34.6±7 days) [5]. Similarly, Cattaneo et al. showed that neonates on KMC were discharged earlier as compared to control group (13.4 vs. 16.3 days, after enrolment) [10].

In this study, weekly increment in length (0.99 vs. 0.70 cm, p=0.021), head circumference (0.75 vs. 0.49 cm, p=0.001), and chest circumference (0.73 *vs.* 0.45 cm, p=0.004) were significantly more in KMC than the CMC group. A significantly higher number of CMC neonates suffered from hypothermia, apnea, and other minor illnesses. More neonates on KMC were exclusively breastfed than CMC at the end of the study (KMC 86% vs. CMC 42%). The result is supported by other studies [9,14].

There is a need for further cost analysis of KMC. It is widely accepted that KMC provides a cost-effective method of care for LBW infants in developing countries where specialized equipments and high skilled staffs are in short supply [1]. These

Table 2: Effect of KMC on various outcome parameters

Variables	KMC (n=50)**	CMC (n=50)**	p value
Weight gain (g/day)	15.9±4.5	10.6±4.5	<0.001
Increase in length (cm/week)	0.99±0.75	0.70±0.45	0.021
Increase in head circumference (cm/week)	0.75±0.48	0.49±0.29	0.001
Increase in chest circumference (cm/week)	0.73±0.48	0.45±0.28	0.004
Hypothermia*	3	18	0.003
Apnea*	1	8	0.035
Other minor illnesses*	8	22	0.035
Exclusive breastfeeding rate*	43	21	0.036
Duration of hospital stay (days)	8±6	14±7	0.039

All parameters are expressed in mean±SD. *Expressed in proportions. **20 neonates were excluded from analysis (10 in each group) as they were loss to follow-up. KMC: Kangaroo mother care, and CMC: Conventional mother care

savings may be a result of decreased consumption of fuel, electricity and maintenance costs of equipments [10]. A study conducted in Ecuador reported lower costs per infant with KMC compared with conventional care, and this was attributed, at least in part, to a reduction in the rates of hospital readmissions [15]. No mortality occurred in both the groups in this study because sick neonates were excluded.

The study was conducted in a resource poor setting mimicking most part of the developing world, so the result can be applicable to these parts of the world. We have an adequate sample size with a good follow-up till discharge. We studied the common outcome parameters that can help in policy decision in our setting.

The limitations of this study include the following: There was a high attrition rate (around 17%). We did not study the neurobehavioral outcomes, and studies have found improved neurobehavioral outcomes in neonates undergoing KMC [16]. We also did not study the role of father in KMC, and studies have found that father can also participate in KMC increasing confidence in care and can also save mother's time who is busy doing household work [17]. A slightly higher (nonsignificant) birth weight in KMC group neonates may have introduced an element of bias regarding favorable outcomes in this group. We could not follow the neonates longer as a longer follow-up for at least for 6 months to 1 year might provide more valuable information on long-term effects of KMC.

CONCLUSIONS

KMC improves growth and breastfeeding rate and reduces morbidities and hospital stay in VLBW neonates. Further evaluation of the effectiveness and safety of implementing KMC in infants before stabilization is needed.

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