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Original Article

Effect of Kangaroo Mother Care on the Growth and Morbidity Pattern in Low Birth Weight Infants

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Abstract

Introduction: Kangaroo mother care (KMC) is defined as skin-to-skin contact between a mother and her newborn baby derived from practical similarities to marsupial caregiving, proximately exclusive breastfeeding, and early discharge from the hospital. This concept was proposed as an alternative to conventional methods of care (CMC) for low birth weight (LBW) infants, and in replication to quandaries of earnest overcrowding in Neonatal Intensive Care Units (NICUs). KMC essentially utilizes the mother as a natural incubator.

Aims and Objectives: The aim of the study was to assess the feasibility, acceptability, and effectiveness of KMC in LBW infants.

Materials and Methods: This is a prospective observational comparative study conducted in the neonatology unit of the Department of Pediatrics Rajindra Hospital, Patiala, and was completed in 2018. Fifty newborns in each of the two groups were included. One group received KMC and the other group received CMC. Weight and head circumference were monitored as per protocol till 2500 g. Feeding in each group was breast milk given 2–3 hourly. If breast milk was not available, formula feed was given and switched to breastfeeding as soon as possible.

Results: The difference in weight gain at 3 months and 6 months was significantly higher in infants receiving KMC as compared to control group. Other parameters were statistically significant between the two groups.

Conclusion: KMC can have a positive effect on the growth of LBW babies in terms of weight which continues even after KMC is withdrawn.

Key words: Kangaro mother care, Low birth weight, Neonatal intensive care

INTRODUCTION

Low birth weight (LBW), which is defined as weight at birth of <2500 g irrespective of gestational age, has an adverse effect on child survival and development.[1] Worldwide LBW is a major problem with an average incidence of 18.0% globally and 33.0% in developing countries. It is a major contributor to neonatal and infant mortality and morbidity with about 30.0% of neonatal mortality related to it in developing countries.[2] In 1979, two neonatologists, Rey and Martinez, introduced a home care program for LBW infants at the overcrowded San Juan de Dios Hospital, Bogota, Columbia, and included care of the infant skin-to-skin between the mothers' breasts in a head-up position.[3] Kangaroo Mother Care (KMC) is defined as early, prolonged, and continuous (or as much as the circumstances permit) skin-to-skin contact between the LBW infant and its mother, or a substitute for her, such as the father or a relative.[4] KMC is started as early as possible in the hospital, can be given during transportation of baby from one part of the hospital to another or any other place, and be continued at home till attainment of appropriate weight, for as long as the infant needs it for temperature control, which can be up to term age. Ideally, the infant should have breast milk as nutrition, be cared for by the mother or relatives at home after early discharge, and be followed up in an appropriate manner.[5] This is a humane low-cost technique for the care of LBW babies.[6] Experiments carried out in developing countries have shown that KMC is safe in terms of mortality and may reduce severe morbidity and avoid hospital readmissions. Therefore, KMC can potentially improve the health and

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survival of LBW newborns, especially in those places where resources are scarce.[7] Experience with KMC is limited in South Asia. There are insufficient data in our own country regarding the acceptability of Kangaroo Care to the mothers and health staff, early discharge policies, and long-term outcomes. This simple method, if found suitable and culturally acceptable, may prove as a new primary modality which can be incorporated into the essential newborn care package of the "Reproductive and Child Health Program." This study aims to provide clinical evidence of the advantages and disadvantages of KMC. The outcome was measured in terms of growth (weight, length, and head growth), mortality, and morbidity in newborns receiving KMC as compared to infants who are given conventional methods of care (CMC).

MATERIALS AND METHODS

This was a prospective observational comparative study conducted in the neonatology and postpartum unit of the Department of Pediatrics on the inborn babies born in the Department of Obstetrics and Gynecology and admitted at Rajindra Hospital, Patiala. The study included two groups each consisting of 50 newborns born with weight <2500 g and gestational age more than 30 weeks. The study group of 50 babies received KMC whereas control group was provided with CMC. Babies requiring inotropic support or with chromosomal/congenital anomalies and babies with respiratory distress, CPAP, or ventilator support were excluded from this study. After stabilization of the newborn in the delivery room gestation was assessed by a new Ballard scoring system[8,9] and the birth weight of the baby was recorded.[10,11] The birth weight of the baby was recorded with an accuracy of 5 g. Mothers or ones who could provide KMC were instructed about the method and advantages of KMC and were motivated to give KMC. Danger signs such as apnea and cyanosis during KMC were also explained. When not in KMC babies were kept well covered in clothes. KMC was advised to be given till gaining 2500 g. The baby's weight was recorded every day in the morning before feeding till discharge. Head circumference was monitored every week till discharge. Length was recorded at birth and then at the time of discharge. Feeding in both the groups was breast milk given 2–3 hourly. When breast milk was not available then formula milk was given and at the same time, mothers were encouraged for NNS and other possible measures to increase breast milk production by shifting to breast milk as early as possible. Babies were discharged as per discharge criteria. The selected babies of both groups were followed up biweekly till 3 months of age then monthly till 6 months of age for follow-up and anthropometry was recorded with the same tools. Along with this babies were looked for any deteriorating event or illness.

During KMC mothers or one providing KMC were asked to wear loose clothes with the front open and babies were held in between the breasts in the upright position, limbs flexed, and head turned slightly to one side not much flexed or extended. Babies were dressed only in diapers and a cap supported at the bottom with a cloth sling and finally covered with their mother's clothes [Figures 2 and 3]. Then the mother was seated and comfortably positioned. It was advised to do KMC for as many hours/day as possible, ensuring a minimum of 6 h/day. If babies passed urine or stools, then diapers were changed and KMC was continued. When not in KMC, the babies were kept warm either in radiant warmer or well-covered in clothes with the mother.[24] In control group, CMC was provided. Babies were adequately clothed, covered with clothes, and kept with their mothers.

RESULTS

A total of 100 healthy newborn babies were enrolled. 54 (54%) were female babies and 46 (46%) were male babies. Out of 50 cases, 28 (56%) were females and 22 (44%) were males. Out of 50 controls, 26 (52%) were females and 24 (48%) were males.

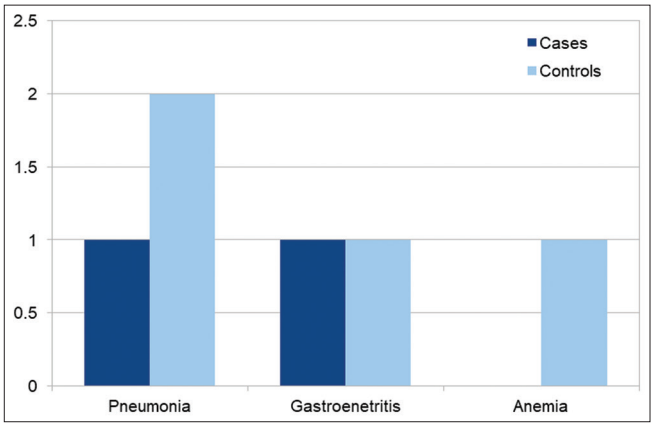

Figure 1: Comparison of morbidities in the form of requirement of readmissions after discharge among cases and controls

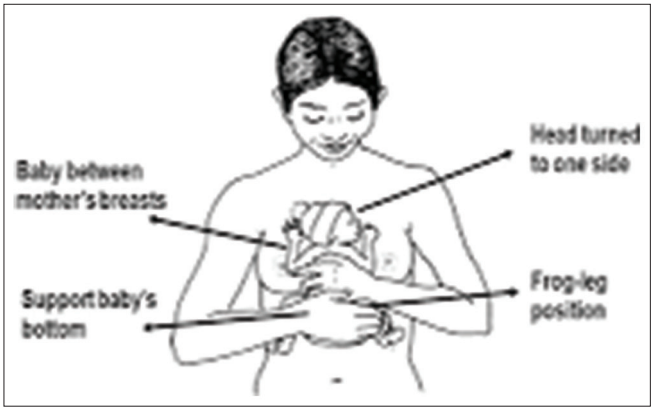

Figure 2: Kangaroo mother care

In our study, baseline characteristics such as gender, gestation, birth weight, weight for gestational age, and HC at birth of cases and controls were similar except for length at birth. A significant difference was seen in length at birth (mean of 44.4 ± 1.9 cm in KMC group vs. 45.2 ± 1.8 cm in control group with $P = 0.04$).

Figure 3: Low birth weight babies

As seen in Table 1, the mean weight gain per day was seen to be 31.0 ± 1.3 g in cases and 24.8 ± 0.6 g in controls which is statistically significant. However, the difference in weight at 1 month was not significant. Weight at 3 and 6 months between the two groups was significantly higher in infants receiving KMC as compared to infants with conventional care.

When comparing the length in two groups, it was observed that the mean length at birth was higher in controls as compared to cases. Although length gain per week is not significant among the two groups, gain in length per week is 1 ± 0.1 cm in cases which is more than in controls in which the gain is 0.8 ± 0.1 cm. Similarly, no difference in mean length was found at 1, 3, and 6 months in both groups [Table 2].

Our study showed no difference in head growth (HC gain per week) between the two groups. Nor there was any

Table 1: Comparison of weight (grams) between the cases and controls at birth and successive time points till the age of 6 months

Variable	Cases		Controls		*P*-value
	Range	Mean±SD	Range	Mean±SD	
Weight at birth (g)	1250–2260	1913±271.8	1200–2300	1915±303.4	0.96 (NS)
Average weight gain (g/day) during hospital	26–33	31.0±1.3	24–27	24.8±0.6	<0.001 (S)
Weight at 1 month (g)	1600–2920	2476.8±308.5	1600–2910	2435.3±324.6	0.5 (NS)
3 months (g)	3400–4730	4282.5±299.2	3200–4570	3984.3±320.1	<0.001 (S)
6 months (g)	5200–6400	6048.2±292.2	4600–6250	5427±353.0	<0.001 (S)

SD: Standard deviation

Table 2: Comparison of length (centimeters) in the cases and control groups at birth and successive time points till the age of 6 months

Parameters	Cases		Control		*P*-value
	Range	Mean±SD	Range	Mean±SD	
Length at birth (cm)	39–49	44.4±1.9	40–48	45.2±1.8	0.04 (S)
Average length gain (cm per week) during hospital	0.6–1.0	1±0.1	0.5–1.3	0.8±0.1	0.29 (NS)
Length at 1 month (cm)	42.5–52.6	48.2±2.0	43.0–52.4	48.7±2.0	0.24 (NS)
3 months (cm)	49.0–57.7	54.6±2.0	50–59	55.4±2.0	0.07 (NS)
6 months (cm)	52–62	60.6±2.0	54–65	59.5±1.9	0.07 (NS)

SD: Standard deviation

Table 3: Comparison of HC in the cases and controls at birth and successive time points till the age of 6 months

Parameters	Kangaroo mother care		Conventional methods of care		*P*-value
	Range	Mean±SD	Range	Mean±SD	
HC at birth (cm)	27.5–33.0	31.3±1.3	29–37	31.5±1.4	0.4 (NS)
Average HC (cm per week) during hospital	0.5–0.7	0.51±0.04	0.4–0.7	0.5±0.04	0.6 (NS)
HC at 1 month (cm)	29–35	33.5±1.1	31–39	33.6±1.3	0.5 (NS)
3 months (cm)	34.5–39.4	37.5±1.1	34–43	37.7±1.3	0.4 (NS)
6 months	38.5–43	40.8±0.9	38–46	40.9±1.2	0.6 (NS)

SD: Standard deviation, HC: Head circumference

Table 4: Comparison of morbidities during hospital stay among cases and controls

Disease	Cases (50) (100%)	Controls (50) (100%)	Chi-square*	*P*-value
Hypothermia	1 (2)	1 (2)	0.00	1.0
Apnea	0	1 (2)	1.0	0.31
Neonatal jaundice	1 (2)	2 (4)	0.34	0.55
Sepsis	0	0		
Minor illnesses – skin pustules etc.	0	1 (2)	1.0	0.31
Total	2 (4)	5 (10)		

*Corrected Chi-square values

significant difference in mean HC at 1, 3, and 6 months [Table 3].

Table 4 and Figure 1 shows the comparison of morbidities such as hypothermia, apnea, NNJ, sepsis, and minor illnesses between the two groups. Our results show that there was no significant difference in mortalities among the two groups.

Out of the total 100 babies, two cases that is 4% of cases and four controls that is 8% of controls required readmission in the hospital after discharge during the follow-up period of 6 months. The data observed are statistically not significant with $P = 0.6$.

Out of 100 babies, there was no mortality during the hospital stay. After discharge during the follow-up period, 1 (2%) of 50 cases among cases expired and 2 (4%) of 50 controls expired. The data were statistically not significant with $P = 0.55$.

The cause of death in the case group was found to be pneumonia at the age of 2 months. In control group, deaths were found to be as a result of severe sepsis within 45 days of discharge.

DISCUSSION

In the present study, it was observed that the average weight gain per day during hospital was more in cases as compared to controls. Similar results have been shown by other studies. In a study conducted by Suman *et al.*,[13] on 206 newborns, it was concluded that the KMC babies had better average weight gain per day (KMC: 23.99 g vs. CMC: 15.58 g, $P < 0.0001$). Similar results were seen in studies conducted by Acharya *et al.*[12] on 126 newborns, by Akhtar *et al.*,[14] by Cattaneo *et al.*,[4] by Samra *et al.*,[15] and by Ali *et al.*[16]

Ghavane *et al.*[17] conducted study on 342 LBW newborns concluded that there was no difference in the weight gain (g/kg/day) from randomization to hospital discharge between the Kangaroo care group and conventional care group (18.01 g vs.15.64 g, $P = 0.12$). The results are not consistent with our present study. The difference can be explained by the fact that in the above study, all the newborns had a lesser weight of ≤1500 g with a mean of 1191 ± 131 g in cases and 1223 ± 125 g in controls.

Our study observed that the length gain per week was 1 ± 0.1 cm in KMC group which was more than 0.8 ± 0.1 cm in control group but the results observed were not statistically significant. In a study conducted by Charpak *et al.*[18] it was concluded that there was no significant effect of KMC on length gain as compared to controls. Suman *et al.*[13] conducted a study in 2008 in which length gain per week was higher in the KMC group. The difference could be due to more number of babies in the given study (206 babies). Swarnkar and Vagha[19] conducted a study in which the length gain per week observed was more in KMC group with $P = 0.001$. The difference with our study could be due to more number of SGA babies in our study and the statistical significance of sex in the above-mentioned study. (male: female 1.14:1 [cases] vs. 1:1 [controls] $P = 0.00$).

In the present study, it was observed that gain in HC per week was not significant between the cases and controls. In a study conducted by Charpak *et al.*[18] greater head growth was seen in KMC group. Suman *et al.*[13] conducted a study which concluded HC was significantly higher in KMC group (33.4 cm) than in control (32.1 cm) with $P < 0.05$. The difference can be due to the small number of babies enrolled in our study as compared to Charpak *et al.* (746 newborns) and Suman *et al.* (206 newborns).

It was observed that the weight was significantly higher in KMC group at 3 months and 6 months with $P < 0.001$. This may be attributed to that the babies of KMC group were given more maternal care, better bonding, and more chances of prolonged exclusive breastfeeding.

There was no significant difference observed in the length and HC at 1, 3, and 6 months of KMC and control groups. As per data, it was observed that the KMC group babies achieved better growth in terms of weight but no significant variation in head growth and linear growth. The results are consistent with a study conducted by Ruiz-Pelaez *et al.*[20] on 746 LBW babies till 12 months which concluded that

no significant difference in physical growth pattern was found. However, many studies have found that the effect on head circumference growth is statistically significant, such as a study conducted by Charpak *et al*.[18] on 1084 infants and followed till 12 months of corrected age. Similarly in a study conducted by Bera *et al*.[21] on 500 mother and baby pairs with follow-up till 12 months of age, the mean weight, length, and HC were significantly more in KMC group. The difference could be due to the large sample size of the above two studies as compared to our study.

In the present study, it was observed that there is no significant difference in morbidity seen in the two groups and it may be due to the small sample size. However, other studies have reported reduced morbidities in KMC groups. One such study was conducted by Cattaneo *et al*.[4] concluded that hypothermia is significantly less in KMC group.

In the present study, it was observed that there was no mortality during hospital stay. The Cochrane review[6] included seven trials that assessed mortality at discharge or 40–41 weeks. These trials reported a statistically significant reduction of 3.4% in the risk of mortality among KMC infants, compared with 5.7% for babies receiving traditional care.

CONCLUSION

In the present study, it can be concluded that the Kangaroo mother has a positive effect on the growth of LBW babies in terms of weight and it is continued even after the KMC is withdrawn after the required period. Although no significant overall effect is seen in length and head growth, there may be a positive effect on HC among early preterm babies as observed at 6 months. No significant effect of KMC is seen in reducing morbidity and mortality. This may require a large study group.

It can be recommended that Kangaroo care for LBW infants. Is definitely feasible, acceptable to mothers, and can be continued at home in the Indian setup. KMC is a cheap and cost-effective intervention in both developed and developing countries. The mere implementation of KMC in the care of LBW infants in developing countries will lead to significant monetary benefits for the parents and also decongestion of Neonatal Intensive Care Units, reduced role of nursing care, and involvement of mother in baby care.

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