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A prospective study on feasibility, acceptability and outcome of kangaroo mother care in low birth weight babies

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Abstract

Background: Low Birth Weight (LBW) continues as an important social health problem. About 20 million LBW babies are born each year worldwide. In India 8 million (40%) LBW babies are born each year. LBW preterm babies are associated with high neonatal/infant mortality and morbidity. Kangaroo Mother Care is an alternative approach for providing thermal care and improving survival of LBW infants which is effective and affordable. The present study was undertaken to study feasibility, acceptability and outcome of KMC in LBW babies.

Aims and Objectives: To study feasibility, acceptability and outcome of KMC in LBW babies with an objective to determine the effect of kangaroo mother care on vital parameters like temperature, respiratory rate, heart rate and oxygen saturation; and to denote the establishment of breastfeeding and weight gain in LBW babies and their duration of hospital stay.

Methodology: A hospital based prospective observational study conducted over a period of one year from September 2017 to August 2018, at SNCU, SVRRGGH, Tirupati. The study subjects are 210 babies.

Results: In the present study, it was observed that there was a significant increase in axillary temperature, decrease in respiratory rate, decrease in heart rate and increase in oxygen saturation observed after KMC which were physiologically favorable. Higher proportion of neonates achieved transition from expressed breast milk consumption to direct breastfeeding during hospital stay. The study showed significant mean weight gain of 20.2 g/day during hospital KMC. Neonates were discharged early as they met our discharge criteria with mean age being 14.3 days. The maternal acceptance of KMC was good. All the mothers providing KMC were satisfied with the training and care. During follow up, it was observed that neonates were all exclusively breastfed; and the velocity of weight gain was satisfactory (153.6 g/week). The response of the family and/or the father was supportive and encouraging.

Conclusion: The present study concluded that practice of KMC promotes breastfeeding, shorten hospital stay without compromising survival, growth and development; and would humanize the practice of neonatology. It is superior alternative to conventional method of care in institutions with limited resources. It is definitely feasible, acceptable to mothers at tertiary care hospital and can be continued at home in the Indian setup.

Keywords: KMC, preterm, LBW, morbidity, hospital stay, breast feeding

Introduction

The most recent definition of KMC: 'a standardized, protocol-based care system for preterm and/or LBW infant, based on skin-to-skin contact between the preterm baby and the mother. It is a conceptually simple, elegant technique in which the role of kangaroo healthcare providers is basically to teach, coach, offer expert counseling, and closely monitor the mother infant dyad. It is not an "alternative" medicine but a scientifically sound, multilevel intervention.

About 20 million LBW babies are born each year worldwide ^[1]. In India 8 million (40%) LBW babies are born each year. LBW preterm babies are associated with high neonatal/infant mortality and morbidity ^[2,3]. Of the estimated 4 million neonatal deaths, LBW/preterm babies account for more than 8laks ^[4]. The important birth outcomes related to LBW include neonatal deaths; short-term morbidities such as hypothermia, hypoglycemia, RDS, infections and necrotizing enterocolitis; and long-term morbidities such as blindness, deafness, hydrocephaly, mental retardation and cerebral palsy.

Incubators, open care systems or warmers used in conventional care are costly and their maintenance and repair are difficult. Frequently incubators separate the babies from their

mothers interfering thus in bonding [5]. KMC is an alternative approach for providing thermal care and improving survival of LBW infants which is effective and affordable. Kangaroo mother care is an effective way to meet LBW baby's needs for warmth, growth and well being; protection from infection, stimulation, breast feeding, safety and love.

Many studies show that babies on KMC had better weight gain and earlier hospital discharge [6, 7]. Furthermore randomized controlled trials carried out in low income countries showed that this method increased the prevalence and duration of breastfeeding [6, 8 & 9]. Once preterm infants are stable, subsequent illnesses like lower respiratory tract infections, apnea, aspiration pneumonia, septicemia; and re-admissions are less with practice of KMC.[8, 9] In addition KMC has a significant positive impact on the infant's cognitive and motor development. Physiological functions such as cardiovascular stability, respiratory rate, oxygenation, gastrointestinal adaptation and sleep patterns observed in infants held skin-to-skin is better than those observed in infants receiving conventional premature infant care. Studies found a significant increase in sleep time for neonates during KMC.

KMC can be adopted as a new kind of postnatal transportation by holding the infant skin-to-skin with mother or care giver [9]. Therefore this is particularly useful in countries where there are inadequate facilities for neonatal transport. Scientific evidences suggest that most of the problems were taken care of when babies were given Kangaroo mother care [10].

In our tertiary care hospital, with 30% preterm and LBW neonates being born each year and many cases being referred from peripheral centers, care of these newborns are a challenging task. Hence, this study is undertaken to evaluate the role of KMC in premature and LBW neonates.

Materials and Methods

Study design: A Hospital based prospective observational study conducted among 210 babies admitted In NHM-SNCU, Sri Venkateswara Ramnarayan Ruia Govt. General Hospital, Tirupathi, over a period of One year from September 2017 to august 2018

Inclusion criteria: Birth weight<2500grams

Exclusion criteria: Critically ill babies, babies with congenital anomalies, babies of critically ill mothers and mothers having psychiatric illness are excluded.

Study method: Informed consent of mother was taken before enrollment in the study.

Once the baby is ready for kangaroo care, mother and her family members were counseled regarding the importance of temperature maintenance, benefits of kangaroo mother care, early breast feeding and benefits of it, skills of breast feeding and expression of milk. Mothers will be educated regarding maintenance of basic standards of hygiene like hand washing, short and clean finger nails, daily bath and clean clothes. Once mother is convinced of safety of the baby in KMC position, they were taught how to hold the infant, after dressing the baby. Babies were dressed in socks, cap and soak-proof diaper. A front open shirt made of natural fabric like cotton was used. Mothers will be shown to hold the baby with one hand placed behind the neck and

back and support the lower part of jaw with finger to prevent flexion of head and blocking the airway when the baby is in upright position, the other hand placed under the baby's buttocks.

Principles of placing the baby in kangaroo position: 1. Baby will be in upright position facing the mother's chest. 2. Baby's chest will be exposed for skin to skin contact with mothers. 3. Head is turned to one side and slightly extended position. This slightly extended head position keeps the airway open and allows eye to eye contact between the mother and the baby. 4. The hips will be flexed in a "frog" position. The arms also should be flexed. Baby will be placed in between the mother's breasts. 5. Babies will be continuously kept in skin-to-skin contact as long as possible. They will be removed only for changing diapers and clinical assessment when needed.

In babies with kangaroo mother care; vital parameters, weight gain, length, head circumference will be measured; feasibility and acceptability among mothers will be analyzed by pretested questionnaire.

Statistical methods: Data was entered using MS EXCEL 2007. Data imported to SPSS 17.0 version software. Descriptive statistics was used to analyze non parametric tests. Chi square test was used to assess significant difference between 2 groups and $p < 0.05$ was considered significant. Student 't' test was used to compare 2 groups of continuous data. $p < 0.05$ was considered significant and $p < 0.01$ was considered highly significant.

Results

A total of 210 babies were enrolled, of which male new borns were 97 (46.19%) and female new borns were 113 (53.8%). There were 135 (64.28%) in born and 75 (35.72%) out born babies.

Table 1: Distribution of neonates according to Gestational Age

Group	No	Percentage
Early Preterm	81	38.57%
Late Preterm	115	54.76%
Term	14	6.66%
Total	210	100%

It is found that majority of LBW new borns born at late preterm followed by early preterm comprising of 54.76% and 38.57% respectively. In our study, neonates delivered by normal vaginal delivery are more with 67.6% (n=142) compared to caesarean delivery of 32.3% (n=68).

Table 2: Age, parity and spacing of mothers of neonates enrolled in our study

Age (YRS)	Number	Percentage
<20	59	28.09%
21-25	118	56.19%
26-30	28	13.33%
31 & above	05	2.38%
Parity		
PRIMI	98	46.6%
Multi	112	53.33%
Spacing in multi para		
<12 months	43	39.39%
< 24 months	42	37.50%
>25 months	27	24.10%

This shows that majority of the mothers were in the age group of 21-25 years (56.19%). Significant LBW babies are born to the mothers whose spacing is <25months.

Table 3: Temperature of neonates before and after KMC

Vitals		Mean±SD	P value
Temperature (°C)	Before	36.77±0.26	< 0.05
	After	36.99±0.25	

The above table shows that there is significant increase in temperature after adapting KMC. Newborns' mean axillary temperature before KMC was 36.77 °C and after +KMC is 36.99 °C, raise by 0.22 °C is found to be significant with P value <0.05.

Table 4: Respiratory rate of neonates before and after KMC

Vitals		Mean±SD	P value
Respiratory rate /min	Before	47.00±3.80	<0.05
	After	43.00±3.20	

From this observation, mean respiratory rate of neonates per min was 43 after KMC care against 47 before KMC. Fall by 4.0 is found to be significant with P value <0.05.

Table 5: Heart rate of neonates before and after KMC

Vitals		Mean±SD	P value
Heart rate /min	Before	148.0±5.27	<0.05
	After	141.0±5.00	

From the above analysis it was observed that there was decreased heart rate after KMC from 148.0 to 141.0 Decrease by 7.0 is found to be significant with P value <0.05.

Table 6: Saturation of neonates before and after KMC

Vitals		Mean±SD	P value
Saturation %	Before	97.00±1.00	0.00
	After	98.20±1.21	

Above table states that there is an increase of oxygen saturation from 97.00 to 98.20. Increase by 1.2 % is found to be significant with P value of 0.00.

Table 7: Feeding methods of neonates before and after KMC

Group	Feeding Method	Pre-KMC	Post-KMC	P value
Term	EBM	1	0	0.52
	DBF	9	10	
Late Preterm	EBM	42	08	0.00
	DBF	70	104	
Early Preterm	EBM	72	12	0.00
	DBF	06	66	

There is significant improvement in direct breast feeding after KMC which is statistically significant.

Table 8: Weight gain in different groups during hospital KMC stay

Group	Mean±SD	Minimum	Maximum
Term	21.62±0.11	7.50	35.00
Late preterm	20.76±8.13	-10.00	50.00
Early preterm	18.23±6.70	-10.00	38.00
Total	20.2±7.76	-10.00	50.00

Table 8 shows average weight gain during KMC stay was 21.62 gm/day in term, 20.76 gm/day in late preterm and 18.23 gm/day in early preterm.

Table 9: Day of weight gain during KMC stay

Group	Mean±SD
Early preterm	8.78±2.52
Late preterm	6.67±1.41
Term SGA	5.9±0.87

It shows that average day of weight gain in early preterm were on 8.78 (SD 2.52) days, late Preterm were on 6.67 (SD 1.41) days and term on 5.9(SD 0.87) days. The average day when neonates started gaining weight was 8.5 days.

Table 10: Duration of hospital stay in Neonates

Type of Stay	Group	Mean±SD	Minimum	Maximum
NICU stay	Term	5.80±1.68	3.00	9.00
	Late Preterm	6.91±3.37	3.00	20.00
	Early Preterm	11.03±3.75	3.00	23.00
Hospital KMC stay	Term	4.20±1.03	3.00	6.00
	Late Preterm	5.96±1.61	4.00	10.00
	Early Preterm	9.20±3.65	4.00	18.00
Hospital stay	Term	10.00±1.63	7.00	13.00
	Late Preterm	12.76±2.26	9.00	18.00
	Early Preterm	20.24±4.96	11.00	34.00

Table 10 Shows average duration of KMC stay in term, late preterm and early preterm was 4.20, 5.96, 9.20 days respectively. But the average duration of hospital stay being 10 days for term, 12.76 days for late preterm and 20.24 days for early preterm.

Table 11: Mortality of neonates enrolled in our study during hospital KMC stay

Pathological condition	No	%
Sepsis	4	1.90
PDA	3	1.42
NEC	1	0.47

Of the 210 LBW babies enrolled for KMC, 8 (3.8%) babies expired due to above mentioned causes.

Table 12: Morbidity of neonates enrolled in our study during hospital KMC stay

Morbidity	No	%
Severe Infection	4	1.90
Poor weight gain	3	1.42
Disability	1	0.47
Death	1	0.47

All the babies enrolled for KMC were advised to come for follow up to evaluate the health status of the newborns. Nearly 194 mothers have brought their babies for follow up. Out of 194 babies who came for follow up 185 babies were found to be in good health. 8 babies had some form of ailments. Death was noted in one child.

Table 13: Weight growth velocity in Neonates during follow-up

Group	Mean±SD (gms/week)	P value
Early preterm	118.05±4.36	0.001
Late preterm	139.58±10.70	
Term	203.20±8.28	

Table 13 shows average weight growth velocity in early preterm was 118.05gm/week, late preterm was 139.58

gm/week and term was 203.2 gm/week, which was statistically significant with p value of 0.001.

Table 14: Feasibility of KMC

Group	Mean day of KMC initiation	Mean day of KMC given in hospital stay	Mean number of KMC hrs/Day	Mean number of KMC hrs/Baby
Term	6.8	4.2	7.8 hrs	32.4 hrs
Early preterm	12.83	9.20	7.64 hrs	69.03 hrs
Late preterm	6.96	5.96	8.13	48.63 hrs

We assessed questionnaire for feasibility and acceptability among mothers. KMC was acceptable to most of the mothers. 64% of mothers were comfortable. 62% of mothers strongly agreed that KMC was a very strong means of bonding between mother and baby. 53% of mothers had a strong opinion of continuing KMC at home.

Discussion

Lowbirth weight (LBW <2500grams regardless of gestational age), which is often associated with preterm birth, is an important predictor of infant death within 28 days of birth^[11]. It is also estimated that, in developing countries, LBW infants are approximately 13 times more likely to die than normal birth weight counterparts^[12]. Medical cost is also significantly higher in caring for preterm and other LBW babies. LBW occurs in about 20-30% of all live births in India^[13].

In the present study it was observed that females (53.8%) were more than males (46.19%). Majority (56.19%) of mothers belongs to the age group of 20-25years. Multiparous mothers were 53.33% when compared to primipara 46.6%. Significant LBW and premature are born to the mothers whose spacing is < 25 months (76.89%).

It is observed that the mean weight gain of babies during KMC hospital stay was 20.2 gm/day; with 21.62 gm/day, 18.23 gm/day and 20.76 gm/day for term SGA, early preterm and late preterm babies respectively. This is in accordance with study done by Suman Rao *et al.* which showed average weight gain of 23.99 grams in KMC groups^[14]. Similarly, experience of Gupta M. *et al.* from Rajasthan India, showed average weight gain of 21.3 grams/day^[15]. In the present study, average day at weight gain in early preterm was on 8.78days; late preterm was on 6.67days and term on 5.9 days.

According to present study, there is significant increase in temperature after adapting KMC. The mean axillary temperature before KMC was 36.77⁰C and after KMC is 36.99⁰C; raise by 0.22⁰C is found to be significant. If baby's temperature in Kangaroo Mother Care decreases by 1⁰C then the temperature of the skin of mother in contact with baby goes up by 2⁰C to warm up the baby rapidly. If baby's temperature increases by 1⁰C, mothers skin temperature decreases by 1⁰C. This phenomenon is called "thermalsynchrony". Therefore the thermo regulation in Kangaroo Mother Care is far superior as compared to other means of keeping the baby warm such as radiant warmer, incubator.

In our study, mean respiratory rate of neonates per min was 47 before KMC against 43 after KMC. Fall by 4.0 is found to be significant with P value < 0.05. This is in accordance with studies done by Almeida *et al.* who studied babies of 1-1.6 kg, have found that there was a significant decrease in respiratory rate by 4 breaths per minute^[16].

In the present study, heart rate decreased before KMC from

148.0 to 141.0 Decrease by 7.0 is found to be significant with P value <0.05. In the current study decrease in mean HR can be explained by the fact that babies, both full-term and preterm cry less when placed in skin to skin contact with their mothers. Heart rate may rise by 5-10 beats per minute during kangarooing rising initially in response to the head tilting upward and later due to infant warming^[17].

This study has shown that there is an increase of oxygen saturation from 97.00 to 98.20. Increase by 1.2% is found to be significant. This is in accordance with studies done by D Sarkar *et al.*^[18] which had shown a significant increase in saturation from 92.3±1.6 to 94.7±2.8 during KMC (p<0.05). Our study recorded a higher proportion of neonates (95.2%) achieved transition from predominant expressed breast milk consumption to predominant direct breastfeeding during hospital kangaroo mother care. This is in accordance with Suman Rao *et al.* (98%)^[14]. The increasing milk volumes in KMC is attributed to the increased oxytocin levels during kangaroo mother care which further enhanced her confidence in breastfeeding.

The average duration of KMC stay in term, late preterm and early pre term was 4.20, 5.96, 9.20 days respectively. But the average duration of hospital stay being 10.0 days for term, 12.76 days for late preterm and 20.24 days for early preterm, with an average hospital stay being 14.3 days for all neonates.

Most of the neonates were observed on follow up at high risk newborn OPD. All mothers were continuing KMC at home. KMC was acceptable to most of the mothers. 64% of mothers were comfortable. 62% of mothers strongly agreed that KMC was a very strong means of bonding between mother and baby. 53% of mothers had a clear opinion of continuing KMC at home. This present study showed average weight gain per week found to be 118.05gm/week in early preterm 139.58 gm/week in late preterm and 203.20 gm/week in term which is significant.

The increase in physical growth more rapidly may be due to exclusive breastfeeding, temperature maintenance, physiologic stability and decreasing morbidities. Although the rate of weight gain was satisfactory, 3 babies showed poor weight gain, who were admitted and evaluated. Other morbidity observed during follow-up were severe infection in 4 requiring hospitalization. One baby with severe infection expired in hospital while undergoing treatment. However, these causes are not directly related to KMC. Conde-Agudelo A *et al.*^[19] found no evidence in difference in infant mortality in KMC as compared to conventional care after stabilization.

In the present study, maternal acceptance of KMC was good and concurred with other studies. KMC was initiated in the hospital under close supervision and guidance and only later continued at home. All the mothers were able to practice KMC at home and no adverse events were reported.

Conclusion

In conclusion, the LBW infants who were offered KMC demonstrated higher growth rates and were discharged earlier. KMC reduced many morbidities of LBW infants. It also promoted exclusive breastfeeding practice and increases mother's confidence in handling small babies and builds good mother-baby binding. KMC should be promoted and mothers should be encouraged to start it as soon as their LBW babies are stable. We recommend Kangaroo Mother Care for low birth weight infants even in tertiary care hospitals. It is definitely feasible and acceptable to mothers and can be continued at home in the Indian setup.

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