ORIGINAL RESEARCH

Prevention of neonatal hypothermia in Himalayas: kangaroo mother care for the term neonates: A randomised controlled trial

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ABSTRACT

Background: Ambient temperature in the mountains of lower Himalaya in Solan falls below 10 °C during the month of October to March and frequently goes below 0^0 C in peak winter days in December and January. Though central air-conditioning and heating systems are available, the obstetric and postnatal wards have large windows and doors with frequent outages of electric supply that powers the heating system. Thus, predisposing the neonates for hypothermia, especially in term healthy neonates who have been co-rooming with their mothers as part of routine care.

Objective: To test the hypothesis that incidence of hypothermia can be reduced by initiating Kangaroo Mother Care (KMC) within 1 hour of birth in term neonates in winter months of lower Himalayas by checking temperature at 1 hour, 6 hour and at the time of discharge.

Methods: Randomised controlled trial was conducted over 120 term newborns (60 control group + 60 intervention group). KMC was started in intervention group at 1 hour of life and axillary temperature, heart rate, respiratory rate and SpO2 was measured at 1 hour, 6 hours and at discharge.

Results: The proportion of neonates in control group with mild hypothermia at 6 hours of life was 26.6% and moderate hypothermia was 3.3%. Severe hypothermia was not seen in either of study groups. No case of mild, moderate or severe hypothermia was seen in interventional group.Mean axillary temperature at 6 hours of life was higher in intervention group and was statistically significant.

Keywords: Kangaroo Mother Care (KMC), hypothermia, term neonates

INTRODUCTION

Normal temperature in a term newborn is 36.5 -37.5° C, mild hypothermia occurs when temperature falls between 36.4 °C and 36 °C. Moderate hypothermia is temperature in range 35.9 °C-32°C and that below 32.0 °C is termed severe hypothermia.[1] Neonatal hypothermia after delivery is not just confined to geographical locations with low temperature but rather a worldwide problem. It occurs in all climatic condition and seasons. Prolonged cold injury has deleterious effects on neonate's health and affects the very survival.[2,3] Neonatal hypothermia has been documented in various studies across both developed and developing countries, with prevalence ranging from 32% to 85%.[2] The incidence of neonatal hypothermia is substantially higher in developing countries compared with developed countries. It is

especially lethal in Africa and Asia owing to poorer health facilities.[4-9]

Before birth, in utero thermoregulation is provided to the foetus by maternal mechanisms. But after birth, newborn must quickly adapt to a relatively cold environment and produce heat to maintain body temperature. Newborns attain thermogenesis in brown fat by metabolic processes only as shivering thermogenesis, which is major source in adults, is not available at this stage of life. Brown fat is highly vascularized collections of fat located in axillae, nape of neck, inter scapular and perineal areas and innervated by sympathetic neurons. Norepinephrine levels increase in response to exposure to cold temperature, and act in the brown fat tissue to stimulate lipolysis. Free fatty acids (FFAs) thus released are subsequently re-esterified or oxidized; with both reactions producing heat. Various factors accentuate risk of hypothermia including prematurity, intrauterine growth restriction, asphyxia, and certain congenital anomalies (e.g., abdominal wall defects, central nervous system [CNS] anomalies).[1]

Neonatal hypothermia has been identified as an important and potentially life- threatening problem in both preterm and term infants. They are especially at risk of developing hypothermia within the first few minutes to hours after birth. In the setting of resuscitation, newborn infants are further subject to acute hypothermia and a vicious cycle of peripheral vasoconstriction, causing anaerobic metabolism, metabolic acidosis and pulmonary vasoconstriction is observed. A thermoneutral environment in neonates is of great importance for somatic growth.[6] A more common and unrecognised chronic problem is cold stress which results in long term caloric loss and failure to thrive.[1]

The WHO has recommended a set of processes called the 'warm chain' (thermoregulation protocol) which is to be used in every newborn from birth until the first few hours to days after birth. The components of warm chain are warm delivery rooms, immediate drying, uninterrupted skin-to-skin contact as much as possible, early breast feeding, delayed bathing and weighing, appropriate bundling, mother and baby together, warm transportation, warm resuscitation, training and raising awareness. However, this thermoregulation protocol is practised only partly in the newborn care settings across the world.[2]

Kangaroo mother care (KMC) is one process among the whole gamut of the thermoregulation protocol, which was initially recommended to be used in preterm infants. Here naked newborn is placed across the bare breasts of the mother inside her clothing with skin-to-skin contact.[10]

MATERIALS AND METHODS

This single centred randomised controlled trial was conducted in Department of Paediatrics in MMMC&H Kumarhatti, Solan during time period of October 2022 to March 2023. The study was approved by the Institutional Ethics Committee. Purpose of study was explained to the family prior to birth of the baby. Consent for enrolment in the study was taken within 10 minutes of birth of the baby. Newborns born via caesarean section, preterm newborns and newborns with congenital malformations or sick newborns were excluded from the study. Total 120 term neonates were enrolled in the study (60 interventional group + 60 controls).

Randomisation was done using randomised number generator using variable block sizes and sealed sequentially numbered envelops. Baseline characteristics such as sex, gestational age, birth weight were noted.

Axillary temperature was measured using digital thermometer in both intervention group and control group at 1 hour of life. The room temperature was also measured using room thermometer. KMC for 6 hours was given in interventional group. The axillary temperature and room temperature were again measured at 6 hours and at the time of discharge in both study groups. Total duration of hospital stay was also noted.

Data collected was entered into Microsoft excel worksheet and data was analysed using SPSS software version 20. Continuous variables were presented as mean and standard deviation and analysed using unpaired T-test. Chi square test was applied for qualitative variables. In this study, p value < 0.05 was considered as statistically significant.

RESULTS

Total 120 newborns were enrolled in this study (60 control group + 60 intervention group). In control group there were 27 males and 33 females. In intervention group there were 39 males and 21 females (Fig 1).

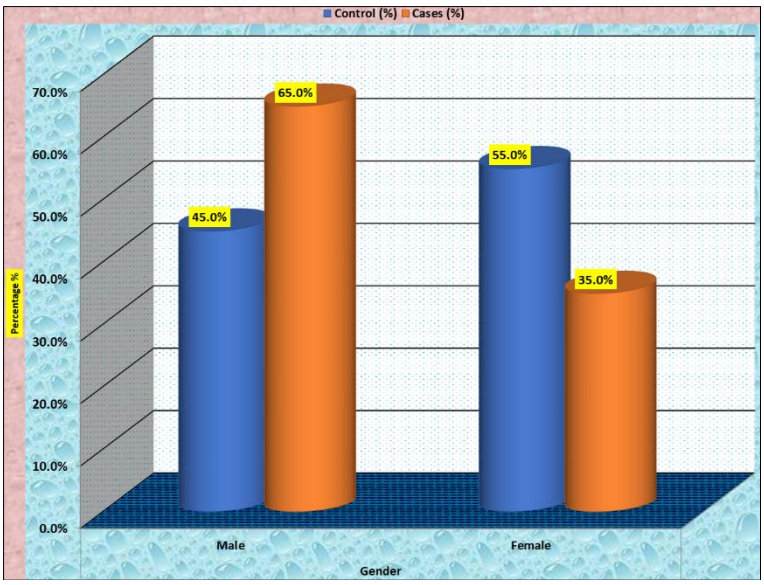

Fig 1:Gender distribution in the study groups

Table 1: Baseline characteristics of the control and intervention groups

Baseline Parameters		Control Group		Intervention Group	
		n	%	n	%
Sex	Male	27	45	39	65
	Female	33	55	21	35
Weight	2-2.5 kg	14	23.3	9	15
	2.6-3 kg	28	46.7	24	40.0
	>3 kg	18	30.0	27	45.0
Gestational Age	37-40 weeks	16	26.7	18	30.0
	>40 weeks	44	73.3	42	70.0
Weight/Gestational Age	SGA	14	23.3	8	13.3
	AGA	46	76.7	52	86.7
	LGA	0	0	0	0
Duration of hospital stay	<2 Days	4	6.7	9	15.0
	3-4 Days	21	35.0	31	51.7
	>4 Days	35	58.3	20	33.3

There was no significant difference in ambient roomtemperature among control group and intervention group either at birth, 1 hour of life, 6 hours of life and at discharge (Room temp ^{0}C, Mean +- SD: Control group16.57+-3.50, 16.5+-3.67, 16.19+-4.31 and 18.34+-4.24, Intervention group 15.31+-3.56, 15.19+-3.73, 14.59+-4.62 and 16.74+-4.42, p value 0.0528, 0.0553, 0.0523 and 0.0512 respectively).

The proportion of Neonates in control group with mild hypothermia at 6 hours of life was 26.6% (n=16) and moderate hypothermia was 3.3% (n=2). However severe hypothermia was not seen in either of study groups. No case of mild, moderate or severe hypothermia was seen in interventional group.Axillary temperature in control group at birth, at 1 hour of life, at 6 hours of life and at discharge was 36.80+-0.22, 37.8+-0.30, 36.70+-0.40 and 36.94+-0.28 respectively. Axillary temperature in intervention group at birth, at 1 hour of life, at 6 hours of life and at discharge was 36.73+-0.19, 36.73+-0.19, 36.87+-0.20 and 36.88+-0.20 respectively. P value was statistically significant at 6 hours of life. Mean axillary temperature at 6 hours of life was higher in intervention group and was statistically significant (p value= 0.0037) (Table 2). Mean heart rate at 6 hours of life measured 137.85+-7.91 in control group and 135.23+-6.19 in intervention group which was statistically significant (p=0.0458). However mean heart rates in both control and intervention group were within normal limits for age (Table 2). There were no adverse events encountered at any time in the study population.

Table 2:Parameters at birth, at 1 hour, at 6 hours and at discharge in control group and intervention group

Parameter		At Birth		At 1 Hour		At 6 Hours		At Discharge	
		Control Group	Intervention Group	Control Group	Intervention Group	Control Group	Intervention Group	Control Group	Intervention Group
HR	Mean +/- SD	139.45 +/- 6.95	136.95 +/- 7.35	137.58+/- 6.97	135.10+/- 7.41	137.85+/- 7.91	135.23+/- 6.19	135.28+/- 7.35	134.30+/- 7.25
	P value	0.0580		0.0611		0.0458		0.180	
RR	Mean+/- SD	51.87+/- 4.41	50.65 +/- 3.76	49.65+/- 3.76	48.75+/- 3.13	48.82+/- 3.44	48.20+/- 3.27	47.82+/- 3.05	48.62+/- 3.57
	P value	0.1067		0.1569		0.3158		0.1892	
SPO2	Mean+/- SD	96.15+/- 1.45	96.52+/- 1.37	97.27+/- 1.25	96.90+/- 1.53	97.50+/- 1.33	97.48+/- 0.97	97.60+/- 1.21	97.38+/- 1.12
	P value	0.1570		0.1522		0.9376		0.3111	
Temp	Mean+/- SD	36.8 +/- 0.22	36.73 +/- 0.19	36.78 +/- 0.30	36.73+/- 0.19	36.70+/- 0.40	36.87+/- 0.20	36.94+/- 0.28	36.88+/- 0.20
	P value	0.0528		0.3087		0.0037		0.2055	

DISCUSSION

This study showed that KMC started at 1 hour of life can reduce chances of hypothermia in term neonates. Mean axillary temperature at 6 hours of life was statistically higher in intervention group compared to control group and there was no statistically significant difference in temperature at the time of discharge. No case of severe hypothermia was found in either groups. This can be because most of the elements of WHO thermoregulation guidelines (warm chain) are well practiced[13]and central heating systems are also available which maintains room temperatures. The incidence of mild hypothermia was 26.6% and moderate hypothermia was 3.3% in the control group whereas severe hypothermia was not found in either of study groups. Similar study was conducted in Zambia in 2014 in which incidence of mild hypothermia in control group was 26.4% and moderate hypothermia was 27%. [9] This study also showed that KMC was effective in preventing hypothermia in term newborns during first few hours after birth.

Another hospital based study was done by Dang R, Patel Al, Weng Y *et al*in 2015 found that incidence of mild hypothermia was 17.1% and moderate hypothermia was 4.6%.[14]

Study conducted by K Christenssonet *al* in Sweden compared temperatures in 50 term newborns, randomization was done and skin to skin contact was given in 25 and in control group newborns were kept in cot. At 90 minutes after birth axillary temperature was noted and found that axillary temperature was significantly higher in skin to skin contact group. [15] In our study also mean axillary temperature was significantly high in intervention group at 6 hours of life.

Amna Mateen *et al* in 2022 did observational quasi experimental study on 60 mother baby duos. KMC was given for 3 hours. The results showed significant increase in temperature (p<0.001). No cases of hypothermia were reported. The increase in heart rate were seen throughout KMC (P<0.001). These results were similar to our study where axillary temperature at 6 hours of life was high in intervention group (p<0.0037).

In 2014 AlpanamayiBera*et al* found in their study that in newborns who received KMC mean HR was increased by 5 beats per minute. They concluded that KMC has statistically significant role in improving vital parameters.[17] In contrast to this study in our study heart rate was significantly high incontrol group at 6 hours of life, however heart rate was within normal limits for age.

CONCLUSION

This study shows that KMC can prevent hypothermia in term neonates during immediate postnatal periodand KMC can be practiced in combination with WHO thermoregulation guidelines. This can significantly reduce hypothermia and thus can prevent deleterious effects of prolonged cold injury onneonate's health. We suggest that in low resource settings KMC can benefit neonates with hypothermia. Further studies are needed from different geographical areas with different settings and environment for further robust results.

ABBREVIATIONS

Kangaroo Mother Care: KMC

Heart Rate: HR

Respiratory Rate: RR

World Health Organisation: WHO

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