

# Interventions to Prevent Hypothermia at Birth in Low Birth Weight Neonates—A Comparison Between Polyethylene Wrap and Embrace Isothermal Mattress Methods

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## Abstract

**Objectives:** To assess and compare the efficacies of polyethylene wrap and embrace isothermal mattress in preventing hypothermia in low birth weight neonates when applied within 10 minutes of birth

**Materials and Methods:** This prospective interventional study was conducted at MS Ramaiah Memorial Hospitals (Bangalore, Karnataka, India). Neonates weighing < 2000 g and admitted to the hospital's neonatal intensive care unit (NICU) were enrolled. Neonates with confirmed diagnosis of external anomalies, visible external anomalies, and who required extensive resuscitation were excluded. Neonates were randomly categorized into 2 groups and received either polyethylene wrap or embrace isothermal mattress intervention. The interventions were applied within the first 10 minutes of birth after initial resuscitation. Rectal temperature was measured before application of intervention and again on admission to the NICU.

**Results:** The mean difference in temperature  $\pm$  SD ( $^{\circ}$ C) before and after intervention in embrace isothermal mattress and polyethylene wrap was found to be  $0.1875 \pm 0.38$  and  $0.004 \pm 0.28$ , respectively ( $P = .051$ ).

**Conclusion:** Both interventions, embrace isothermal mattress and polyethylene wrap, were found to be effective in maintaining the temperature of the neonate and thereby preventing hypothermia.

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**Key Words:** Neonatal intensive care unit, nonshivering thermogenesis, preventative action, resuscitation, digital rectal thermometer, birth weight, radiant warmer

## Introduction

Neonatal hypothermia is defined by the WHO as temperature < 36.5°C.<sup>1</sup> The prevalence of hypothermia in neonates born at hospitals ranges between 32% and 85%.<sup>2</sup> Consequences of hypothermia include hypoglycemia, respiratory distress, hypoxia, metabolic acidosis, coagulation defects, delayed readjustment from fetal to newborn circulation, acute renal failure, necrotizing enterocolitis, failure to gain weight or weight loss, and in extreme cases death.<sup>3</sup>

There is a progressive fall in the body temperature of a newborn as a part of the transition from the intrauterine to extrauterine environment.<sup>1</sup> The newborn cannot shiver<sup>4</sup> and relies on nonshivering thermogenesis, thus necessitating interventions to protect it from exposure to cold. In low birth weight neonates, thermoregulatory mechanisms are easily overwhelmed due to factors such as large surface-to-mass ratio<sup>5</sup> and inadequacy of subcutaneous fat, hence making preventative action vital to prevent cold exposure. Preventative action has to be taken by reducing heat loss and/or providing warmth using external heat sources. Thus, this study aims at preventing hypothermia in low birth weight neonates using 2 different methods and determining their efficacies. The purpose of this study was to provide information about the management of neonatal hypothermia so as to implement appropriate preventative actions and reduce the morbidity and mortality caused by it.

## Aim

To assess and compare the efficacies of polyethylene wrap and embrace isothermal mattress in preventing hypothermia in low birth weight neonates when applied within 10 minutes of birth

## Materials and Methods

This was a prospective interventional study conducted at a tertiary care hospital. The study was approved

by the institutional ethics committee and informed consent was taken from all parents. Forty neonates born at MS Ramaiah Memorial Hospitals (Bangalore, Karnataka, India), with a birth weight < 2000 g, and admitted to the hospital's neonatal intensive care unit (NICU) were enrolled. Neonates born with confirmed diagnosis of anomalies, visible external anomalies, and those requiring extensive resuscitation were excluded from the study.

The neonates were randomly allocated into 2 groups of 20 each and received either polyethylene wrap or embrace isothermal mattress intervention. Immediately after the initial resuscitation under a radiant warmer (neonate was not wiped in case of polyethylene wrap), the weight of the neonate was recorded and then the rectal temperature was recorded using a digital rectal thermometer (Safety 1st gentle read rectal thermometer, Dorel Industries, Montreal, Quebec, Canada). The allocated intervention was then applied. In case of the embrace isothermal mattress intervention, the WarmPak (Embrace, Oakland, CA, USA) was kept heated and ready to use at all times using the AccuTempHeater (Embrace). The WarmPak was placed in the pouch designed for the same at the back of the BabyWrap. The neonate was wiped, covered in a sterile cloth, and placed in the BabyWrap (Embrace). In case of polyethylene wrap intervention, a polyethylene wrap (NeoWrap™, Fisher and Paykel Healthcare India Pvt Ltd, Bangalore, Karnataka, India; made of transparent biomedical grade plastic; product code NC100-10) was opened under the radiant warmer after initial resuscitation except wiping the neonate. The wet neonate was then placed on the wrap from the shoulders down and wrapped according to the manufacturer's instructions. The neonate was then wrapped in a sterile cloth and transferred to the NICU from the delivery room.

Upon admission to the NICU, the rectal temperature of the neonate was recorded using the previously

used digital rectal thermometer. Other data were recorded from the patients' case files. Quantitative parameters such as rectal temperature and birth weight were expressed as mean  $\pm$  standard deviation. Qualitative parameters such as gender and mode of delivery were expressed as frequency and percentage. A difference in the mean values between the 2 groups, embrace isothermal mattress versus polyethylene wrap, was tested for statistical significance using Mann-Whitney test. Similarly, for testing the differences in proportions  $\chi^2$  test was employed. Data were entered in Microsoft Excel and analyzed using SPSS version 18.0 (International Business Machines Corporation, Chicago, IL, USA).  $P < .05$  was considered statistically significant.

## Results

Tables 1, 2, and 3 depict the study results.

**Table 1.** Baseline Quantitative Parameters

Parameters	Both Groups	Embrace Isothermal Mattress Group	Polyethylene Wrap Group	P Values
Gestational Age, wk (mean $\pm$ SD)	32.98 $\pm$ 2.77	32.9 $\pm$ 2.62	33.05 $\pm$ 2.89	.864
Birth Weight, g (mean $\pm$ SD)	1589.5 $\pm$ 341.28	1552 $\pm$ 318.97	1627 $\pm$ 366.52	.494

**Table 2.** Baseline Qualitative Parameters

Parameters	Overall, n (%)	Embrace Isothermal Mattress Group, n (%)	Polyethylene Wrap Group, n (%)
Appropriate for Date	23 (57.5)	12 (52.1)	11 (47.82)
Intrauterine Growth Retardation	17 (42.5)	8 (47.05)	9 (52.94)
Lower Segment Cesarean Section	29 (72.5)	13 (44.82)	16 (55.17)
Vaginal Delivery	11 (27.5)	7 (63.63)	4 (36.36)
Male	25 (62.5)	14 (56)	11 (44)
Female	15 (37.5)	6 (40)	9 (60)

**Table 3.** Comparison of Differences in Temperature Before and After Intervention

Differences in Temperature	Embrace Isothermal Mattress Group (n = 20)	Polyethylene Wrap Group (n = 20)	P Values
Mean $\pm$ SD ( $^{\circ}$ C)	0.1875 $\pm$ 0.38	0.004 $\pm$ 0.28	.051 <sup>a</sup>
Range ( $^{\circ}$ C)	- 0.56 to + 1.11	- 0.33 to + 0.56	NS

NS, not significant.

<sup>a</sup>Statistically significant (Mann-Whitney test).

## Discussion

In this study, we aimed to determine whether the 2 methods of intervention, polyethylene wrap and embrace isothermal mattress, are effective in maintaining temperature and thereby preventing hypothermia.

The analysis of difference in temperature before and after the interventions showed that both methods maintained temperature of the neonate and thereby prevented hypothermia. There was a statistically significant difference in the mean rectal temperature before and after the intervention in both the groups. However, an affirmative conclusion can be drawn only after further research. Based on the mean temperature difference before and after the intervention, embrace isothermal mattress group showed a mean increase in the temperature of  $0.1875 \pm 0.38$  and polyethylene wrap group showed maintenance of temperature with a mean of  $0.004 \pm 0.28$ .

In the current study, both embrace isothermal mattress and polyethylene wrap interventions were able to maintain the temperature of the neonate and thereby both the methods are effective in preventing hypothermia. (Mean temperature difference before and after intervention  $\pm$  SD ( $^{\circ}$ C) was  $0.1875 \pm 0.38$  and  $0.004 \pm 0.28$  in embrace isothermal mattress and polyethylene wrap groups, respectively, with  $P = .051$ ).

A study by Almeida et al<sup>6</sup> shows that occurrence of hypothermia (defined as temperature  $< 97.4^{\circ}$ F) was significantly lowered when a transport mattress was used in very low birth weight neonates. This can be compared with the embrace isothermal mattress used in

the current study. A similar finding is seen in the current study wherein the embrace isothermal mattress is effective in maintaining the temperature of the neonate and thereby preventing hypothermia.

Chawla et al,<sup>7</sup> in their quasi-randomized controlled trial on preterm neonates, concluded that the use of a transwarmer mattress results in significantly higher temperatures in cases than in controls (mean [standard deviation] = 36.2°C [0.8] vs 35.7°C [0.8] in cases and controls, respectively). Hence, external heat sources are effective in preventing hypothermia in neonates.

A study conducted by Knobel et al<sup>8</sup> found that the occurrence of NICU admission hypothermia in preterm infants born < 29 weeks of gestation could be reduced by placing them in polyurethane bags immediately after birth. The wet neonate was placed in the polyurethane bag immediately after birth and before resuscitation and the intervention did not interfere with the resuscitation procedure. In the current study, the polyethylene wrap was applied after resuscitation.

In a study conducted by Vohra et al<sup>9</sup> a methodology similar to the current study was adopted. Neonates born < 28 weeks of gestation were included. All neonates were stabilized under a radiant warmer in the delivery room. Neonates in the control group were dried completely and neonates assigned to the wrap group were placed from the shoulders down on a polyethylene bag opened under the radiant warmer with only the head dried. This showed that the mean rectal temperature on admission to the NICU was significantly higher in the wrap group when compared with the control. The mean temperature (°C) at NICU in the wrap group was  $36.5 \pm 0.8$  whereas in the control group it was  $35.6 \pm 1.3$ .

This study also shows that all neonates weighing < 2000 g (both preterm and intrauterine growth restricted) were able to maintain a normal temperature on NICU admission.

A comparative study between thermal warming mattress and polyethylene sheet during resuscitation, conducted by Simon et al<sup>10</sup> showed that thermal mattress improved admission temperature better over

polyethylene sheet, which is in agreement with our study where embrace isothermal mattress was considered to be similar. In the thermal warming mattress, the transwarmer mattress provides additional heat to the neonate. In embrace isothermal mattress, the WarmPak provides additional heat to the neonate. Hence, the 2 techniques are comparable in terms of efficiency. In comparison, BabyWrap works by preventing heat loss from the neonate, thus preventing hypothermia.

Studies by McCarthy et al<sup>11</sup> and Singh et al<sup>12</sup> have showed that use of an exothermic mattress along with polyethylene wrap increases the risk of hyperthermia in neonates. However, no cases of hyperthermia were observed in our study. Also, the interventions did not cause any side effects in both the study groups.

The limitation of this study is its small sample size due to which clinical recommendations cannot be stated.

## Conclusion

The 2 methods of intervention, polyethylene wrap and embrace isothermal mattress, were found to be effective in maintaining the temperature of the neonate, thereby preventing hypothermia.

The statistical significance needs to be viewed with caution owing to the small sample sizes and large measures of variances; hence, further research with a large cohort is warranted.

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