Original Article

The Effect of Polyethylene Swaddle in Hypothermia Prevention among Low Birth Weight Neonates

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Abstract

Background: Hypothermia appears predominant among low birth weight (LBW) newborns. This condition tends to instigate severe medical complications, including acidosis, cerebral hemorrhage, hypoglycemia, and hyaline membrane disease. **Objective:** The purpose of this study was to examine the effectiveness of swaddling technique in hypothermia prevention among LBW neonates. **Methods:** This randomized controlled trial was conducted on 40 recent babies (20 controls and 20 interventions), using a pre- and post-test design. In the intervention group, a polyethylene swaddling was used, and in the control group, a cloth swaddling was used. Digital axillary thermometer was used to detect the body temperature. Mann–Whitney *U*-test and Wilcoxon test were employed to examine the temperature difference between the two groups. **Results:** This observation showed a trend toward improvement in average temperature in the intervention group (pre 34.8°C, post 36.4°C) compared to the control group (pre 33.3°C, post 34.9°C). There were significant within-group changes in both groups ($P < 0.05$) although no significant difference was found between the two groups ($P = 0.267$). **Conclusions:** Both polyethylene and cloth swaddling methods showed improvement in neonate temperature. These methods are therefore highly recommended as alternatives in hypothermia prevention among LBW infants.

Keywords: *Body temperature, Hypothermia, Low birth weight, Neonates, Plastic swaddling, Polyethylene*

Introduction

The term low birth weight (LBW) is used to describe newborns with weights below 2500 g.[1] This global medical challenge occurs approximately among 15%–20% of 20 million births per year.[2] Based on the 2015 World Health Organization (WHO) survey, 1 out of 7 cases of the above estimation suffered LBW, particularly in Asia. In addition, LBW is believed to be responsible for about 70% of neonate mortality, extending to 15 out of 1000 stillbirths in Indonesia.[1] The babies diagnosed with this condition appear more vulnerable to hypothermia,[3] brain hemorrhage,[4] hypoglycemia,[5] respiratory failure[6] and onset of noncommunicable disease in the life course.[7] LBW increases the risk of hypothermia due to several reasons including thinner epidermis stratum corneum layer, low subcutaneous fat, higher body surface area, and unbalanced vasomotor responses known to prevent excess vasoconstriction.[8] The WHO has released thermal care procedures as a basic precaution during birth and in the 1st-day of life. These techniques include skin–skin or other temperature stabilization methods in the early initiation of breastfeeding, kangaroo approach, postponement of umbilical cord cutting, use of head protection (cap), swaddled bathing, mattress, and exothermic beds.[9-17]

Low-cost and technological interventions are strongly recommended for neonate temperature stabilization and

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hypothermia prevention, particularly in low-resource settings.[18] Several studies highlighted the effective application of plastics in maintaining neonate temperature. This technique appears as a major intervention in hypothermia deterrence among LBW cases, based on the ability to resolve dehydration, convectional heat loss, and persistence.[19-24] Previous studies have also reported the successful use of plastic bags in temperature elevation and maintenance for 1 h. However, some neonates still experience hypothermia.[19,20,25] This problem is already remediated at the perinatology room of the Dr. Slamet General Hospital using plastic swaddling although no current guideline distinctly indicates the material type and specific adoption method. Therefore, further development is required to achieve extensive performance and easy-to-use wrapping models. Previous researches reported a plastic polyethylene design similar to swaddle, which is intended to cover the entire baby's body, except the face.[20,21] Moreover, polyethylene-based swaddles with 1.2 mm thickness are estimated to potentially protect the head and body segments from direct contact with cold environment. The preliminary survey conducted at Dr. Slamet General Hospital showed that the limitation of heating facilities, including incubators and radiant heaters, hindered meeting the prevailing high demands. In addition, existing amenities are disproportional to the number of births, particularly with increasing cases of LBW. This clinical situation triggered a limitation in the admission of infants in need of incubators and has intensified the risk of prolonged LBW treatments. Furthermore, the resulting delays are also attributed to the emergence of other hypothermia-related complications, including hypoglycemia and hypoxia.

Objectives

The present study aimed at evaluating the effectiveness of polyethylene plastic swaddling technique in hypothermia prevention among LBW neonates.

Methods

Study design and participants

This study commenced from June to August 2020, using a consecutive sampling method. The inclusion criteria encompassed neonates with birth weight between 1000 and 2000 g and free from certain medical conditions, including neural tube, congenital, or abdominal wall defects, and babies born of mothers without fever. The exclusion criteria comprised reluctant parents and neonates with unstable vital signs within 30 min of arrival at the perinatology room of Dr. Slamet General Hospital, Garut, Indonesia. To determine the sample size of LBW neonates due to the unknown population, total sampling covering June–August 2020 was introduced, and finally, 40 participants (20 intervention and 20 controls) were employed [Figure 1].

Data collection instrument

The temperatures were measured using axillary thermometer with three similar pediatric digital versions (Omron, Japan). The data were obtained by two authors (S and A) and two research assistants. The thermometer was sterilized with 70% alcohol, before each reading. The present study required temperature observations before, during, and also at the end of the intervention, specifically at the release of the cotton and plastic swaddling after 6 h.

Intervention

The neonates were transferred to the perinatology ward immediately after birth. Subsequently, the parents were informed about the objectives, advantages, and disadvantages of the study. This was followed by the formation of the intervention and control groups (1:1), relating to the first- and second-order placement, respectively, based on parental approval. Furthermore, the babies were placed under a radian warmer, and the vital signs were collected in terms of stable respiration, pulse, and color. Participants in the intervention group were covered with swaddle polyethylene plastic (comprising a 1.2-mm thickness with a nonspecific brand, including the use of low-density polyethylene sheets), to cover the body and head, but not the face, in an effort to prevent drying due to humidity moderation. Neonates in the control group were exposed to similar procedures but enclosed with a swaddle cotton material (particularly designed by the hospital for special use as a nonspecific brand).

Ethical considerations

This study was endorsed by the Health Research Ethics Committee of the Institute of Health Science Dharma, Husada, on June 13, 2020 (approval code: 03/KEPK/

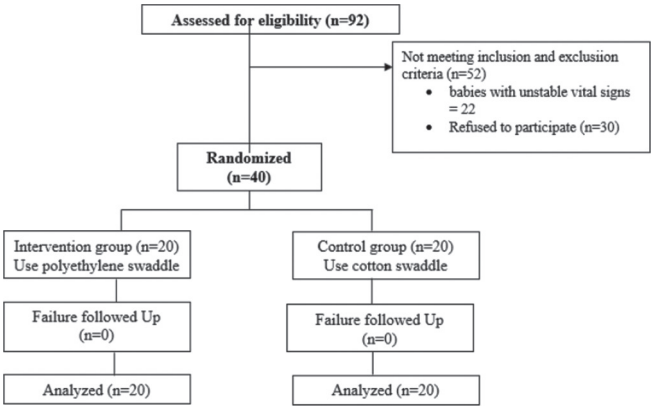

Figure 1: The study flow diagram

SDHB/B/VI/2020). Parental approval was obtained, and they were reassured of the freedom to voluntarily withdrawal as well as the confidential data management. Possible refusal did not by any means affect the needed childcare. The entire respondents were required to acknowledge written consent of participation.

Data analysis

The data analysis involved the use of SPSS software version 16 (SPSS, Inc., Chicago, IL, USA), and the normality of the numerical data was assessed by Shapiro–Wilk test. Normally distributed outcomes were followed by parametric evaluation. However, abnormally distributed values were evaluated using nonparametric approach. Frequency, mean, standard deviation, and 95% confidence interval were employed for the data description. Mann–Whitney *U*-test and Wilcoxon tests were used for within-group and between-group comparisons, while the statistical significance level was set at <0.05. A statistical counselor was used to determine the analysis method through a blind assessment and without any data source information.

Results

The neonates in the intervention and control groups were not significantly different based on gender, weight, and type of labor [Table 1]. The results showed an average neonatal temperature of 34.8°C and 36.4°C prior and after treatment, respectively, in the intervention group. Meanwhile, the control was estimated at 33.3°C and 34.9°C, correspondingly. There were significant changes within both groups ($P < 0.005$), but no significant difference was found between the two groups ($P = 0.267$) [Table 2].

The average temperature changes were similar in both groups. However, a change was observed after 6 h of treatment, particularly in the intervention group. Therefore, plastic swaddles have been demonstrated to reduce heat loss from evaporation, inhibit radiation from the displaced barrier, and further enhance the body temperature.

Discussion

Although showing no significant difference between the study groups, the use of plastic and cloth swaddling as an intervention technique showed improvement in neonate temperature. Therefore, both methods are highly recommended as an alternative to prevent hypothermia in LBW infants.

This study showed the effectiveness of plastic swaddling in hypothermia prevention among LBW infants from the admission time up to 6 h of treatment in the perinatology room. The observation was attributed to the plastic nature of the pad, known to avert temperature decline due to external contact. Our findings are congruent with several previous studies, where the application of plastic caps and swaddling proved effective to prevent hypothermia.[20,21,24,25] Furthermore, polyethylene was also employed during the transfer of premature neonates from the obstetric spaces to the neonatal intensive care unit.[26] Therefore, as a nursing intervention option, providing plastic swaddling immediately after birth can be confirmed as an effective technique, particularly for LBW neonates. This method instantly reduces heat loss by 30%–34%, particularly by evaporation. This method is also practical and economic, especially on the covered body parts.[22] Plastic swaddle is an effective, efficient, cheap, easy, and safe method in hypothermia prevention among LBW neonates and is also devoid of any allergies or possible hyperthermia. This technique is potentially applied in health services deprived of medical equipment and also during the transfer of neonates after referrals. However, there is a need to continuously remove the swaddle after the problem is reduced. This is because persistent hyperthermia poses a risk of hypoxic–ischemic encephalopathy.[27] However, further investigations on the possibility of long-term hyperthermia appear necessary. The minimal participation in this study appears as a major limitation, although there is a need to generate a supporting result in similar researches with greater involvement. Further, the use of data-matching factor, the repeated temperature

Table 1: Participants' characteristics

Characteristic	Intervention, *n* (%)	Control, *n* (%)
Type of delivery		
CS	11 (55)	12 (60)
NVD	9 (45)	8 (40)
Sex		
Female	7 (35)	12 (60)
Male	13 (65)	8 (40)
Weight (g) (mean)	1553.15	1200.05

NVD: Normal vaginal delivery, CS: Cesarean section

Table 2: Bivariate analysis of the average body temperature of participants in intervention group and control group

Group	Mean±SD		*P* (Wilcoxon test)
	Pre	Post	
Intervention	34.8±1.20	36.4±0.91	0.001
Control	33.3±0.17	34.9±0.56	0.001
P (Mann-Whitney)	0.000	0.267	

SD: Standard deviation

measurement, and the evaluation of other vital indicators require further analysis.

Conclusions

Based on the results and discussion, the use of plastic swaddling as an alternative intervention in hypothermia prevention among LBW neonates is recommended in midwifery and nursing units. Therefore, the results of this study can potentially be applied in the provision of adequate care for the newborns, including hospital referencing and proper resource allocation, in a bid to prevent hypothermia.

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Conflicts of interest

There are no conflicts of interest.

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