Original Article

Effect of two polyethylene covers in prevention of hypothermia among premature neonates

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Abstract

Background: After the umbilical cord is cut, premature neonates face numerous problems including hypothermia. With regard to serious complications of hypothermia and incapability of conventional methods in preservation of neonates' temperature after admission, the researcher decided to conduct a study on the effects of two polyethylene covers in prevention of hypothermia among premature neonates.

Materials and Methods: This clinical trial was conducted on 96 neonates aged 28–32 weeks that randomly allocated, by drawing of lots, to three 32-subject groups as follows: Intervention group 1 (a plastic bag cover and a cotton hat), intervention group 2 (a plastic bag cover and a plastic hat), and a control group receiving routine care. Data were analyzed by descriptive and inferential statistics through SPSS V.14.

Results: Mean axillary temperatures in intervention groups 1 and 2 were different after admission and 1 and 2 h later, but this difference was not significant and the mean axillary temperature increased with time. Mean axillary temperature in the control group showed no significant difference at these time points and it did not increase with time. The mean temperatures in preterm infants were significantly higher in the intervention groups after admission and 1 and 2 h after birth, compared to the control group. Mean axillary temperature in intervention group 2 was significantly higher than in intervention group 1.

Conclusions: Usage of a plastic bag cover and a plastic hat (with no risk of hyperthermia) is more effective in preventing hypothermia among neonates aged 28–32 weeks, compared to usage of a plastic bag cover and a cotton hat.

Key words: Hypothermia, polyethylene cover, premature neonate

Introduction

Birth is a beautiful, miraculous and, sometimes, the most risky phenomenon during one's life. Human body needs an extraordinary physiologic regulation and coordination immediately after birth.[1] Of all creatures, human beings need the longest time for being developed and for blossoming of his/her abilities and capacities, as he/she is born with the lowest abilities and needs much special care.[2] It is more important to provide this sort of care for premature neonates.[3] Early delivery and a premature neonatal birth are among the major health problems and the most common causes for neonatal mortality.[4] World Health Organization (WHO) reported 15 million premature birthzappening in a year in different countries (premature neonates).[5]

Neonates, especially premature neonates, face a common problems of heat loss.[6] Warming a neonate at the moment of birth is a crucial issue.[7,8] Hypothermia is a dangerous sign which can lead to increased neonatal mortality among premature neonates at birth. The main cause is high surface/body weight ratio among the neonates. The body surface of a newly born term infant, compared to its weight, is threefold more than that of an adult.[7] It reaches fivefold to sixfold, especially in very low weight neonates. In addition, body dehydration due to evaporation in very low birth weight neonates is 8–10-fold more than in adults. Therefore, high evaporation in premature neonates plays a pivotal role in their metabolism and heat loss. Due to low existing fat in the epidermis, absence of protective fat on premature neonates' skin, inadequate energy to warm their body, and finally, reduced vasomotor response to cold stress, they are prone to a high risk of hypothermia.[9] The incidence of hypothermia among premature neonates under 1500 g is between 31% and 78%.[10] Based on WHO criterion,

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temperatures between 36 and 36.4°C are considered as minor hypothermia, between 32 and 35.9°C as moderate, and less than 32°C is considered as acute hypothermia.[7,8] Although the factor of cold stress can be used to trigger neonates' respiration mechanism in the delivery room, the neonates should not be exposed to low temperature for a long time.[11] Long-term environmental low temperature causes destructive complications for the neonates, such as hypoglycemia, metabolic acidosis, cold hands, legs, and body, neonatal mottling, and irregular and slow respiration, bradycardia, apnea or respiratory distress, coagulation and circulation disorders, renal failure, necrotizing enterocolitis, and a defect in thermoregulation (hyper- or hypothermia), and in acute cases, it causes death.[7,12] With regard to aforementioned issues, one of the important duties of nurses is prevention of hypothermia and warming the neonates during their transition from the operating room or delivery room to the ICU.[9] Making appropriate conditions and regulation of neonates' environmental temperature immediately after birth is among nurses' responsibilities.[13] One of the ways to keep premature neonates warm is using polyethylene transparent nylon covers. These nylon bags are also used for packing the food.[9] This transparent cover is used in the form of a swaddle for neonates less than 30 weeks immediately after birth to prevent heat loss.[13] This cover reduces skin evaporation and heat loss, as the skin is not directly exposed to air and it acts as an isolation to prevent the heat passing from neonates' body. In addition, as the infant is laid in the bag after drying, the vernix caseosa remains on its skin and prevents heat loss.[10] In a study conducted in Turkey on 60 premature neonates under 1500 g, the infants who were laid in polyethylene covers reached their normal body temperature sooner than controls.[9] In a study conducted on the incidence of hypothermia in England in a group covered by polyethylene bags, although the incidence of hypothermia reduced from 25 to 16%, in a high number of these neonates, hyperthermia was reported (12.5% vs 39.8%, respectively).[14] A study in Italy showed that the group covered in a polyethylene bag and those with a polyethylene hat had a higher temperature, compared to controls. They concluded that a polyethylene hat and bags were efficient in prevention of heat loss from premature neonates.[6] A study in Iran showed a reduction in prevalence of hypothermia in the group laid in polyethylene plastic bag, compared to controls. Resuscitation time was also significantly lower in this group, and only one case of hypothermia was reported.[3] It is noteworthy that some recent studies reported controversial results and concluded that usage of polyethylene plastic bags led to hypothermia in neonates and its related complications. A study conducted on neonates under 30 weeks of age during their transition to neonatal ward reported that usage of polyethylene bags in neonates after delivery led to hypothermia in them.[15] Another study in France in 2010 reported that usage of polyethylene plastic bags to cover 29–31 week premature neonates could predispose them to the risk of hyperthermia and its complications.[16] In most of the studies, neonates' body was laid in a polyethylene cover up to their neck without drying, although neonates' head is much bigger than other parts of their body (one-fourth of their height) and its circumference is more than their chest circumference. About 40% of their body mass is their head.[17] In comparison with a term neonate, premature neonates' body surface and weight ratio is more as their head is bigger than their trunk, and consequently, the risk of their hypothermia is higher.[18] Even in a study conducted in Newzealand, the subjects' heads were not covered by a plastic hat, and the researchers suggested covering the neonate's head by a plastic cover in future studies to prevent hypothermia. They argued that the big size of the head in neonates and its high proportion of the body surface was the reason for this.[19] With regard to the complications and the importance of prevention of hypothermia in premature neonates, and as there was no comparative study in this context, the researchers decided to compare two interventional protocols of a plastic cover with a plastic hat and a plastic cover with a cotton hat in prevention of premature neonates' heat loss at their birth in Alzahra and Shahid Beheshti hospitals in Isfahan in 2013.

Materials and Methods

Ethical considerations

This is a clinical trial conducted in the neonatal wards of Alzahra and Shahid Beheshti hospitals during November–March 2013 on 96 neonates selected through convenient sampling and assigned to two interventional groups of polyethylene bag with cotton hat and polyethylene bag with polyethylene hat, and one control group by random allocation ($n = 32$ in each group).

Inclusion criteria were: 28–32 week old neonates; the neonates without neural tube defects, congenital obvious anomalies, congenital dermal diseases, or abdominal wall defects; the neonates not born from mothers having fever; and the neonates of age more than 28 weeks and of weight 900 g. Exclusion criteria were: Subjects' parents' loss of interest to continue with the study, neonates' expiration, neonates' urination in the polyethylene bag, and having no stable vital signs 30 min after arriving at the neonatal intensive care unit (NICU). The researcher started the intervention after the subjects' parents signed a consent from and received explanations of the research goal and method. Data collection tool was a checklist. Demographic characteristics were collected through referring to subjects' medical files, observation, and interviewing their mothers and recording the data in an information note. The neonates in group 1 intervention were laid in a 25–40 cm

heat-resistant polyethylene plastic bag (by the researcher and her colleagues) covering up to the neck of neonates, which had been already heated up under a warmer without drying, immediately after their birth and cutting their umbrical cord in the labor room or operating room. Their heads were covered by a cotton hat after drying. The neonates in group 2 intervention underwent the same procedure, but their heads were covered by a polyethylene, already warmed-up hat with no strips, without drying.

The control group underwent routine care (being dried by a cloth and being placed under a warmer). Neonates were transferred from the labor room or operating room to the neonatal ward and were placed under warmer after checking their vital signs concerning stable respiration, pulse, and color, in a portable incubator already regulated on 35°C. Then, neonates' axillary temperature was measured with a pediatric digital thermometer (Omron, Japan) through a hole made in the polyethylene cover. The length of intervention (wearing the polyethylene cover) was 1 h. All physical interventions were administered on the plastic bag. In cases of an emergency need for a naval venous catheter or placing a pulse oximeter, tiny holes were made in the bag. Neonates' body temperature was measured in all stages (at admission and at 1 and 2 h after admission) in the three groups. The obtained data were entered into SPSS version 14 and analyzed by Chi-square, repeated measure analysis of variance (ANOVA), and independent *t*-test.

Results

There were 98 subjects in the present study of whom 2 were excluded. One subject was excluded due to urination in the bag during transfer and another due to a critical condition needing resuscitation through which the subject was expired. Totally 96 subjects were randomly assigned to three groups. Most of the subjects were boys in each group (53.1%). Chi-square test showed no significant difference between the three groups ($P = 0.85$). Independent *t*-test showed no significant difference in subjects' demographic characteristics (gestational age, birth weight, transfer time, APGAR score) between the three groups ($P > 0.05$). Chi-square test also showed no significant difference in the frequency distribution of delivery mode between the three groups ($P = 0.73$). One-way ANOVA showed a significant difference in neonates' mean temperature at birth and at 1 and 2 h after admission between the three groups ($P < 0.001$). Repeated measure ANOVA showed no significant difference in neonates' mean temperature in control ($P = 0.32$), cotton hat ($P = 0.48$), and plastic hat ($P = 0.41$) groups between the three time points [Table 1]. *Post-hoc* least significant difference (LSD) test showed a significant difference in neonates' temperature at admission time and at 1 and 2 h after admission in polyethylene and cotton groups, compared to control ($P = 0.001$). The difference in mean temperature of neonates was significant between a polyethylene bag and a cotton hat and between a polyethylene bag and a polyethylene hat [Table 2].

Discussion

Results showed a significant difference in neonates' temperature at admission and at 1 and 2 h after admission between the three groups. There was an insignificant difference in neonates' temperature in control ($P = 0.32$), cotton hat ($P = 0.48$), and polyethylene hat ($P = 0.41$) groups between the three time points. In fact, mean temperature in the two intervention groups was less at admission compared to 1 h after admission, and neonates' temperature was less at 1 h after admission compared to 2 h after admission (temperature at admission <1 h after admission <2 h after admission). Mean temperature of neonates in the cotton hat group nearly reached 36.5°C at 1 h after admission, while it reached 37°C in the polyethylene hat group. Farhadi *et al*. concluded that covering the neonates up to their neck by polyethylene cover increased their temperature within the first hour after admission (36.60 to 37.31°C). Trevisanuto *et al*. showed that

Table 1: Mean temperatures of premature neonates in three groups at various time points

Group	Temperature at admission		Temperature at 1 h after admission		Temperature at 2 h after admission		Repeated measure ANOVA	
	Mean	SD	Mean	SD	Mean	SD	F	*P*
Control	35.97	0.81	36.01	1.16	35.84	1.25	1.18	0.32
Polyethylene bag with cotton hat	36.41	0.72	36.47	0.74	36.58	0.62	0.75	0.48
Polyethylene bag with a polyethylene hat	36.73	0.47	36.84	0.63	36.95	0.42	0.93	0.41
Repeated measure ANOVA								
F	14.7		11.89		20.43		-	
P	<0.001		<0.001		<0.001		-	

SD: Standard deviation, ANOVA: Analysis of variance

Table 2: Comparison of pair temperatures at each time point in the groups (*post-hoc* test)

Groups	*P* (mean difference)		
	At admission	at 1 h after admission	at 2 h after admission
Control, polyethylene bag, and cotton hat groups	0.005 (0.44)	0.003 (0.46)	0.001 (0.74)
Control, polyethylene bag, and polyethylene hat groups	0.001 (0.76)	0.001 (0.83)	0.001 (1.11)
Polyethylene bag and cotton hat, and polyethylene bag and polyethylene hat groups	0.001 (0.32)	0.008 (0.37)	0.005 (0.37)

covering the neonates with a polyethylene bag up to their neck increased their temperature within the first hour (36.1 to 36.5°C), which is in line with the present study.[3] Our obtained results showed a significant difference in neonates' mean temperature between control, polyethylene bag, and cotton hat groups and between control, polyethylene bag, and polyethylene hat groups ($P = 0.001$). There was also a significant difference between polyethylene bag and cotton hat groups and between polyethylene bag and polyethylene hat groups at admission and at 1 and 2 h after admission. Gathwala *et al*. showed that covering the neonates with vinyl bag up to their neck increased the subjects' recorded axillary temperature at admission in the intervention group, compared to control ($P < 0.01$). Mean axillary temperature was slightly higher in the intervention group at 1 h after admission, but the difference was not significant; therefore, they recommended usage of vinyl bags during resuscitation, which is not in line with the present study despite the fact that the neonates' body was covered by a vinyl bag up to their neck in that study.[10] Farhadi *et al*. concluded that mean axillary temperature of the neonates covered by a polyethylene bag up to their neck was significantly higher than that of controls at admission in the neonatal ward and 1 h after, and prevalence of hypothermia was less in the polyethylene group compared to control.[3] Trevisanuto *et al*. reported that the neonates' temperature was higher in polyethylene bag and polyethylene hat groups, compared to control. They claimed that polyethylene hats and bags were efficient in prevention of premature neonates' heat loss,[6] which is in line with the present study. It is noteworthy that some controversial studies concluded that using a polyethylene bag may lead to occurrence of hyperthermia and its complications among the neonates. A study conducted on neonates under 30 weeks of age during their transfer to neonatal ward showed that usage of polyethylene bags after birth led to hyperthermia in neonates.[16] Overall, our findings showed that using a plastic cover and hat for the premature neonates aged 28–32 weeks is more efficient in prevention of hypothermia (with no risk of hyperthermia), compared to using a plastic bag and a cotton hat. These findings can be considered in taking care of the neonates during resuscitation, transition, and admission. Low number of subjects can be considered as a limitation of the present study. Therefore, another study with a higher number of subjects is suggested to be compared with the present study.

Conclusion

Based on our obtained results, it is suggested to prevent neonates' hypothermia and its complications through holding educational programs and by the prevailing usage of a polyethylene cover for neonates' whole body, in order to lower the hospitalization costs. This cover is especially recommended for the hospitals in which operating rooms or labor rooms are not next to neonatal ward, as usage of transparent covers among the neonates under warmer prevents their heat loss during transfer to the ward.

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