

Polyethylene wrap for maintaining the body temperature of the newborn

Cobertura de polietileno para manutenção da temperatura corporal do recém-nascido
Cubierta de polietileno para el mantenimiento de la temperatura corporal del recién nacido

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Abstract

Background: Clinical area of Neonatal Nursing.

Objectives: To assess the effectiveness of the polyethylene wrap, identify its benefits, and describe nursing care provided to maintain the body temperature of preterm infants.

Methodology: A prospective and descriptive study was conducted at the Obstetric Centre and at the Neonatal Intensive Care Unit in Fortaleza, Brazil, between July and September 2011. The subjects were 10 preterm infants with a birth weight $\leq 1,500$ grams and ≤ 32 weeks of gestational age. The infants were placed in a polyethylene bag immediately after birth and their body temperature was monitored.

Results: The results show that the polyethylene wrap is effective in maintaining the body temperature of the infant during the first two hours of life.

Conclusion: The polyethylene wrap is a heating resource/device used in nursing care to maintain and stabilize the infant's body temperature.

Keywords: infant newborn; premature; nursing care; body temperature regulation.

Resumo

Enquadramento: Área clínica de Enfermagem Neonatal.

Objetivos: Avaliar a eficácia da cobertura de polietileno; identificar seus benefícios e descrever os cuidados de enfermagem para a manutenção da temperatura corporal do recém-nascido (RN) prematuro.

Metodologia: Estudo prospectivo e descritivo, realizado no Centro Obstétrico e na Unidade de Terapia Intensiva Neonatal em Fortaleza-Brasil, no período de julho a setembro de 2011. Os sujeitos foram 10 recém-nascidos prematuros com peso ≤ 1.500 gramas e idade gestacional ≤ 32 semanas. Logo após o nascimento, estes foram colocados em saco ou cobertura de polietileno com monitorização da temperatura corporal.

Resultados: Os resultados obtidos revelam: a eficácia da cobertura de polietileno para a manutenção e eficácia da temperatura corporal do RN nas primeiras duas horas de vida.

Conclusão: A cobertura de polietileno é um recurso/ dispositivo de aquecimento utilizado nos cuidados de enfermagem para manutenção e estabilidade da temperatura corporal do RN.

Palavras-chave: recém-nascido; prematuro; cuidados de enfermagem; regulação da temperatura corporal

Resumen

Introducción: Área clínica de Enfermería neonatal.

Objetivos: Evaluar la eficacia de la cubierta de polietileno; identificar sus beneficios y describir la atención de enfermería para mantener la temperatura corporal del recién nacido (RN) prematuro.

Metodología: Estudio prospectivo y descriptivo en el Centro Obstétrico y en la Unidad de Terapia Intensiva Neonatal de Fortaleza (Brasil), en el período de julio a septiembre de 2011. Los sujetos fueron 10 recién nacidos prematuros con un peso de < 1.500 gramos y una edad gestacional de < 32 semanas. Poco después del nacimiento, se los colocó en una bolsa o cubierta de polietileno con una monitorización de la temperatura corporal.

Resultados: Los resultados obtenidos demuestran la eficacia de la cubierta de polietileno para el mantenimiento y la eficacia de la temperatura corporal del RN en las primeras dos horas de vida.

Conclusión: La cubierta de polietileno es un recurso / dispositivo calefactor usado en la atención de enfermería para mantener estable la temperatura corporal del RN.

Palabras clave: recién nacidos; prematuros; atención de enfermería; regulación de la temperatura corporal

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Introduction

Premature newborns (NB) lose weeks of stimulation in the womb and disorders of thermoregulation are one of the main complications related to prematurity. Because of the limited capacity for self-protection of their thermoregulation system, NB can easily lose heat and body temperature, and succumb to the severe physiological consequences of hypothermia. Together with the immaturity of the immune system, hypothermia can increase the risk of mortality and morbidity in NB (Ringer, 2013).

Unlike post-neonatal mortality, which is mainly related to socio-economic and environmental factors, neonatal mortality (a death during the first 28 days of life) is associated with both biological factors and the access to and the quality of the care provided during pregnancy and childbirth and to NBs (Pereira, 2007). In Brazil, in 2010, the mortality rate in low-birth-weight NBs (weighing between 1,500 grams and 2,500 grams) was 19.2% (Ministério da Saúde, 2012). This high rate emphasises the need for greater attention and adequacy of immediate care to these high-risk NBs.

In this context, it is essential to direct first care to maintaining the body temperature of premature newborns (PNB), namely adjusting the external environment to reduce heat loss via evaporation, conduction, convection, and radiation, drying the NB completely and, above all, providing a thermoneutral environment during transfer to the Neonatal Intensive Care Unit (NICU) (Sobel, Silvestre, Mantaring, Olivero, & Nyunt, 2011).

As a result of prematurity, nursing interventions in neonatal units focus on problems related to physiological maturation.

The thermoregulatory system should be highlighted because thermoregulation is a critical function for NB survival, regulated in the hypothalamus and mediated by endocrine pathways. Hypothermia activates cellular metabolism through shivering and non-shivering thermogenesis. In NB, optimal temperature ranges are narrow and thermoregulatory mechanisms are a little unstable, particularly in premature and low-birth-weight infants. The lack of thermal protection promptly leads to hypothermia, which is associated with detrimental metabolic and other pathophysiological processes. Simple thermal protection strategies are feasible at community and

institutional levels in resource-limited environments. Appropriate interventions include skin-to-skin care, breastfeeding and protective clothing or devices for body temperature regulation (Lunze & Hamer, 2012). In a study conducted with 26 PNB, Magalhães et al. (2010) found that the incidence of routine handling of the NB for the first 24 hours ranged from 52 to 79, with most of the procedures being performed by the Nursing team. These findings reflect an excessive handling, which can also hamper the stability of the body temperature due to cold stress, changes in vital signs, behavioural change and even risk of physiological changes such as intracranial haemorrhage.

To promote the maintenance of the body temperature of PNB in NICUs, Rolim et al. (2010) assessed the effects of wrapping the NB at risk in a polyethylene plastic bag immediately after birth. The authors found that when the NB was wrapped up to the neck, the rectal temperature, which was measured by a digital thermometer before and one hour after using it, increased by 1.54 °C. No adverse effects such as hyperthermia, skin infection or maceration due to its use were reported.

Based on these findings, it becomes clear that the thermoregulation of NB should be a constant concern of the Nursing team in NICUs, with a particular focus on hypothermia prevention and management. These findings might help improve NB survival in resource-limited settings, as well as to include families in the provision of NB thermal protection and training of professionals from the multidisciplinary health team for using thermoprotective practices in NICUs (Lunze et al., 2014).

Research questions

We highlight the importance of evidence-based research so as to make it possible to use new technologies, such as the polyethylene wrap, to improve the quality of life and survival of PNB.

The following guiding questions should be highlighted: What is the effectiveness of the polyethylene wrap in maintaining the body temperature of PNB? What are the benefits of the polyethylene wrap as thermoregulation resource? What type of nursing care is provided to maintain the body temperature of PNB? Therefore, the present study aimed to verify the

effectiveness of the polyethylene wrap in maintaining the body temperature of the PNB, assess the benefits of this wrap, and describe the Nursing care provided to maintain the body temperature of PNB.

Methodology

A cross-sectional descriptive study was conducted between July and September 2011. The subjects were selected by convenience among the NB in the neonatology unit of the Obstetric Centre (OC) and the NICU in the city of Fortaleza-Ceará, Brazil, including the transfer of the NB at risk from the OC to the NICU.

The sample consisted of ten PNB weighing ≤1,500 grams and with ≤32 weeks of gestational age. PNB with any type of skin lesions were excluded.

Data were collected using an instrument with explanatory, independent or predictor variables for the identification of PNB, such as gender, weight, gestational age, body temperature, identification of clinical procedures and events or critical incidents with NB in the first two hours of life, and monitoring of their temperature before and after using the polyethylene wrap through a digital thermometer.

The sampled PNB were placed in a polyethylene bag and accompanied during the transfer from the

OC to the NICU, where their axillary temperature was measured after wrap removal. This procedure sought to assess the need for and the benefits of the wrap, as well as the Nursing care provided to maintain the body temperature of PNB.

The data and the results were presented in tables and analysed based on a theoretical/ conceptual framework. The information was systemised using descriptive and inferential statistics. Data were statistically analysed using SPSS, version 21.0 (2012). The study was approved by the Research Ethics Committee of the institution, under order no. 070/11 and opinion no. 36/11, while respecting the ethical and legal aspects.

Results

To facilitate data presentation, we will first characterise the PNB who used the polyethylene wrap for maintaining body temperature. Then, we will describe the effectiveness of the polyethylene wrap, by showing the temperature variations in degrees Celsius (°C) and the time spent in the polyethylene wrap (in minutes).

With regard to the characterisation of NB, most PNB had a mean gestational age of 28 weeks and a mean birth weight of 1,041 grams, as shown in Table 1.

Table 1
PNB characteristics by gestational age and birth weight

	n	X Min.	X Max.	X	s
Gestational age	10	24	32	28.50	2.461
Birth weight	10	590	1370	1041.50	249.634

The temperatures in degrees Celsius (°C) of these NB varied according to the time spent in the polyethylene wrap (in minutes). In other words, the temperature varied between 0.5 °C and 0.6 °C with the use of the polyethylene wrap for maintaining the body

temperature of NB. This shows that the polyethylene wrap can play an important role in maintaining or even increasing the body temperature of the PNB in the first hours of life, as shown in Table 2.

Table 2
Effectiveness of the polyethylene wrap in maintaining the body temperature of PNB

	n	X min	X Max	X	s
T (°C) before wrapping	10	33.9	35.5	34.7	0.6303
T (°C) after wrapping	10	34.4	36.2	35.4	0.5272
Time spent wrapped (min.)	10	25.0	51.0	37.7	0.4728

We have chosen to always cover the head of the PNB, as it makes up 25% of the total body surface of the NB. The axillary temperature of PNB was checked every six hours, and the Nursing team continuously and systematically monitored the signs and symptoms of PNB, considering the need to reduce this measurement interval in order to detect obvious or subtle changes in baseline clinical or laboratory data, thus detecting a problem (real or potential) as early as possible and reducing the risk of complications, which in some cases makes the difference between life and death.

Nurses working at the NICU should understand the thermoregulatory system of the PNB, taking into account aspects such as increased viability, the relatively larger body surface in relation to weight, the inadequate thermal insulation, and the very low and extremely low birth weight to reduce handling,

improve care, and reduce the morbidity and mortality rates of NB at risk.

For this reason, during the stay in the Neonatology Room of the OC and the NICU, it is important to reinforce the benefits of the wrap and the Nursing care as favourable and essential conditions to maintain the body temperature of PNB. Thus, this study showed that the main benefit of the polyethylene wrap is the increase and preservation of the body temperature of the PNB.

In view of these results, we emphasize that the nurses working at these units can and should implement strategies aimed at health promotion and prevention of risk factors for hypothermia, thus reducing neonatal morbidity and mortality rates.

Nursing care should be directed to/focused on a correct diagnosis and clinical decision-making (nursing intervention focused on hypothermia prevention), as shown in Table 3.

Table 3
Key nursing procedures to maintain the body temperature of PNB

Nursing Care:
Clean and dry the NB to remove the amniotic fluid
Monitor behaviour patterns
Monitor body temperature
Monitor the conditions of temperature and oxygenation
Monitor vital signs
Monitor for signs and symptoms of hypothermia (temperature drop) and hyperthermia (temperature increase, facial flushing, sweating)
Use an appropriate thermometer, polyethylene wrap and stockinet cap in the PNB, when available and indicated
Control the thermoneutral environment by monitoring the temperature of the transfer incubator
Control the thermoneutral environment by monitoring the temperature of the NICU incubator
Document Nursing records

The following Nursing care aimed at maintaining the body temperature of the NB should be highlighted: monitor signs and symptoms of hypothermia (temperature drop) and hyperthermia (temperature increase, facial flushing, sweating); use an appropriate thermometer, polyethylene wrap and stockinet cap in the PNB, when available and indicated; control the thermoneutral environment by monitoring the temperature of the incubator.

Anticipatory care or preparation to receive the PNB are also very important, such as prewarming the equipment (incubator or radiant heat cradle), using preheated field to wrap the neonate, and washing hands and using gloves to handle the

infant and perform the physical examination. Here, thermoregulation should be a constant concern.

To care for the PNB and/or NB with thermal instability, it is important to use the Systematization of Nursing Care (SAE – *Sistematização da Assistência de Enfermagem*) to identify real problems of risk or situations of well-being, establish Nursing diagnoses, plan care directed at maintaining the balance of body temperature, and implement Nursing care aimed at promoting the thermoneutral environment of PNB, as well as provide ongoing evaluation to identify outcomes and/or other problems, such as heating the head, as it corresponds to a large area of the body surface with high heat loss.

Discussion

In line with the results of this study are the studies of scholars such as Rolim et al. (2010), who reported that heat loss is higher in very-low and extremely-low-birth-weight infants, as well as in those who are under radiant heat and not under the thermoneutral environment of the incubator, even when there is protection against heat loss.

The PNB is usually hypothermic in a restricted range of environmental temperature, with a tendency to imbalance between two basic mechanisms of thermoregulation: increased heat loss and decreased endogenous heat production. For this reason, it is essential to maintain the body temperature of the PNB in the different environments: in the delivery room, in which there is a need to avoid transepidermal water loss and control temperature, during stabilization and upon admission to the NICU (Bissinger & Annibale, 2010).

During the transition to extrauterine life, the core temperature of the NB decreases with the environmental temperature and the PNB condition. Initially, the core temperature of the NB decreases around 0.3 °C per minute (Kenner, 2001), which suggests the need for strategies to maintain the body temperature in PNB during the first hours of life.

The present study highlights the effectiveness of the polyethylene wrap to cover the PNB after birth. A variance of 0.5 °C to 0.6 °C was identified in the maintenance of the body temperature of the NB after being wrapped, on average, for 37.7 minutes. These data corroborate the study by Çalır, Gözen, & Ince (2014) who showed that the loss of body temperature was significantly lower in the infants placed in the polyethylene bag than in the infants placed in a vinyl bag for 60 minutes after birth. It can thus be concluded that the use of these devices is an effective strategy for maintaining the body temperature of the PNB.

The Nursing care provided to these NB at risk should be a holistic and resolute care, using a main Nursing diagnosis of risk designated as altered body temperature (Rolim, Mendonça, & Ponte, 2012).

Therefore, nursing care should focus on the maintenance of body temperature at normal levels, which can be achieved through activities such as: drying the NB at birth to prevent heat loss by evaporation, preheating the cradle or incubator,

adjusting it to the NB needs, keeping the NB warm as quickly as possible, and assessing the clinical conditions. Some procedures responsible for promoting heat loss include: clinical examination, bathing, and transfer. These procedures should be performed along with the monitoring of vital signs so as to avoid complications (Rolim et al., 2010).

Other types of care include the use of an appropriate thermometer, polyethylene wrap, and stockinet caps, when available and indicated. The importance of using an appropriate thermometer was confirmed in the results of a study (Rolim et al., 2012) conducted in 2012 with 29 PNB hospitalised in a NICU. The authors measured the NB temperature before being manipulated by the unit's staff, using digital and mercury thermometers. They found that the digital thermometer (or portable electronic thermometer) is more effective and easier to use than the mercury thermometer.

The use of a stockinet cap in all PNB should also be highlighted. This is in line with studies (Rugolo, 2000) which consider that the stockinet cap is a useful tool to prevent heat loss through the head, maintaining and promoting a thermostable environment for PNB and reducing heat loss. A thermoneutral environment should be controlled and maintained by monitoring the temperature of the incubator, as it can easily cool down or overheat. In addition, inappropriate care and anatomophysiological conditions may trigger episodes of hypothermia, which is defined as a core body temperature below 35 °C. Thus, the use of technologies to maintain the body temperature of the PNB is recommended, such as heated humidified oxygen and a heated incubator (Scochi, Gaiva, & Silva, 2002).

If the PNB has to be transferred, priority should be given to safety and the maintenance of respiratory homeostasis, hemodynamics, and temperature. The studies on the problems related to the intra-hospital transfer of NB are scarce, but significant changes may affect the vital signs, including body temperature, heart rate, breathing rate, blood pressure, oxygen saturation, and partial pressures of oxygen and carbon dioxide. Researchers such as Vieira et al. (2007) pointed out that, even with the adequate preparation of the PNB, the transfer conditions (for example, excessive noise, vibration and temperature changes) compromise the clinical stability of the NB.

Thus, a differentiated attention should be given to the

thermoregulation of PNB, as, when exposed to acute hypothermia, they peripherally vasoconstrict, leading to anaerobic metabolism and metabolic acidosis which may lead to pulmonary vasoconstriction, hypoxia, and further anaerobic metabolism and metabolic acidosis (MacDonald, Mullet, & Seshis, 2007).

The ventilation, temperature and humidity of the hospitalisation unit must be adjusted to the neonates' needs. Thus, the temperature should be constantly adjusted through the thermostat and humidity should be around 65% or above. The body temperature of the PNB should be measured after birth and in the hospitalisation unit, and other vital signs such as heart rate, respiratory rate, and blood pressure should also be assessed (Oliveira & Rodrigues, 2005).

Knobel, Wimmer, and Holbert (2009) also report that the evaporation of the amniotic fluid in the body surface of the NB is the main heat loss mechanism in the period immediately after birth. Another mechanism is the heat loss to the environment due to cooling of the delivery room or transfer of the neonate to low temperatures in the NICU admission (MacDonald et al., 2007).

The work of the Nursing team in the Neonatology Unit of the OC in the first few minutes is essential, with the preheated polyethylene wrap being used under warm linen to wrap the PNB. In addition, wet towels should be removed and stockinet caps should be used to reduce heat losses by radiation and even during resuscitation. It should be underlined that the polyethylene wrap must be kept until the PNB is homeostatically stabilised, i.e. the team usually waits 30 to 60 minutes (Bissinger, 2010).

PNB are more vulnerable to hypothermia due to low brown fat stores and low ability to produce heat and prevent losses (Kenner, 2001). Therefore, this study corroborates the assertion that the polyethylene wrap is an effective device or technology to minimise heat loss, as it maintains and increases the body temperature of the NB when assessed in the OC and upon NICU admission.

The nursing records and the use of the SAE are also important cyclic and dynamic technical-scientific strategies in Nursing care. The use of the SAE can facilitate the identification of health/disease situations, subsidizing nursing interventions that can contribute to the promotion, prevention, recovery, and rehabilitation of the health of the NB, family and community. The family's capacity of response and

adaptation to the hospitalisation experience of the NB is also important, as the couple's normal expectations towards their child (who is often expected and idealized) are dashed when the baby requires hospitalisation and intensive care immediately after birth (Silva, Barroso, Abreu, & Oliveira, 2009).

The knowledge of the nursing care team about the environmental risk factors during the process of neonatal adaptation in the Neonatology Unit and NICU is essential for the provision of humane, relational, technical, and scientific care. This requires professionals working there to provide a humanised and quality care based on aspects such as organization, improvement of professional exercise, adequate functioning of equipment, and use and valuation of technologies and materials used in the procedures (Rolim et al., 2012).

A limitation of this study is the need for further research with higher level of evidence to enable changes in evidence-based practice in terms of the type of nursing care provided to maintain the body temperature of the PNB.

Conclusion

The results of this study show the effectiveness of the polyethylene wrap for maintaining the body temperature of the PNB. Its benefits include a significant heat loss reduction, and the fact that it is a cost-effective, practical and easy-to-use method which does not interfere with the handling of the neonate. Nurses have a major responsibility for maintaining a thermoneutral environment and should be aware of the good practices implemented in the NICU to help reduce the morbidity and mortality rates of PNB. The complexity of prematurity makes it necessary to use technologies for maintaining the body temperature, such as the polyethylene bag.

The benefits of the polyethylene wrap include: improved care to the PNB as a result of a better identification of the signs of thermal instability so as to avoid iatrogenic diseases, and reduction of hospital costs and length of hospital stay.

We are strongly convinced of the need for further studies. Therefore, we recommend an effective thermoregulation, attitudinal changes, development of the profession, and an improvement of the quality of nursing care.

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