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Occlusive polyethylene method to treat hypothermia in baby with low birth weight

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Abstract
Low Birth Weight (LBW) is a condition of babies with a birth weight of less than 2500 grams. Babies with LBW tend to experience problems due to immaturity of the organ system. One of the biggest problems is the limitation in regulating body temperature which can cause hypothermia. Occlusive polyethylene is one way to overcome hypothermia by putting the baby in a plastic bag. The case study aimed to describe the application of the occlusive polyethylene method to LBW with hypothermia care problems in patient at RSUD Tidar, Magelang. The results of the study showed that the application of the occlusive polyethylene showed positive results as improved thermoregulation. The application of occlusive polyethylene can be an alternative non-pharmacological therapy to maintain thermoregulation in infants with LBW.

Keywords: Body temperature, hypothermia, Low Birth Weight, nursing care, paediatric nursing

Introduction

Health is a fundamental human need, and a nation's health status can be measured by its infant mortality rate (IMR) (Gonzalez & Gilleskie, 2017). The IMR is defined as the number of deaths of infants under one year of age per 1,000 live births in a given year (Derso et al., 2023). As a key indicator of public health, a high IMR suggests inadequate healthcare and poor health outcomes. One significant contributor to high infant mortality rates is low birth weight (LBW), which can lead to various health complications and increased vulnerability to diseases (Wardani et al., 2022). LBW babies are at risk of growth problems, cognitive deficits, developmental delays, behavioural issues, motor delays, cerebral palsy, and temperature regulation difficulties, such as hypothermia. Globally, approximately 3 million babies die during the neonatal period each year, with over 80% of these deaths attributed to infections, asphyxia, birth complications, prematurity, and LBW (Wang et al., 2016). In Indonesia, LBW is a leading cause of neonatal deaths, and the same trend is observed in Central Java, including Magelang City. The major causes of mortality in LBW babies include asphyxia, infections, congenital abnormalities, and other complications (Barton et al., 1999; Lin et al., 2007). Understanding the causes and consequences of LBW is crucial for developing effective strategies to reduce infant mortality rates and improve health outcomes.

Hypothermia is a significant complication in LBW infants, characterized by a body temperature below 36°C (Miller et al., 2011). This condition is associated with increased morbidity and mortality due to the infant's limited ability to regulate body temperature (Shi et al., 2022). LBW infants are prone to heat loss due to their low-fat content, which causes their skin pores to be more extensive, and their immature thermoregulation center. If left untreated, hypothermia in LBW infants can lead to severe complications, including hypoxia, metabolic acidosis, hypoglycemia, and even death (Manani et al., 2013). Normal body temperature ranges from 36.5°C to 37.5°C (axillary temperature). Hypothermia in LBW infants often occurs due to several factors, including limited subcutaneous fat tissue, a large body surface area relative to weight, inadequate muscle growth, inability to shiver, and immaturity of the nervous system that regulates body temperature (Mohamed et al., 2021). The relatively large body surface area-to-weight ratio in LBW infants also contributes to heat loss, making them more susceptible to hypothermia. Hypothermia in newborns can have significant long-term effects on their health and development. It can impact brain development, leading to delays in cognitive, motor, and language development. Severe hypothermia has also been linked to an increased risk of cerebral palsy and other motor disorders. Additionally, hypothermia can affect brain development, leading to behavioral and emotional problems, such as attention deficit hyperactivity disorder (ADHD). Furthermore, hypothermia can impair growth and development, leading to short stature, delayed puberty, and other growth-related problems (Sanni et al., 2024). There is also evidence to suggest that hypothermia may increase the risk of chronic diseases, such as diabetes, hypertension, and cardiovascular disease, later in life. Early recognition and treatment of hypothermia are crucial to preventing these long-term effects, and healthcare providers should prioritize thermoregulation and provide appropriate care to newborns, especially those at high risk, such as low birth weight or premature infants.

Several methods can help maintain body temperature stability in LBW infants, including the Kangaroo Mother Care (KMC) method, Skin Wrap Method, and Occlusive Polyethylene Method. One effective approach is using plastic bags or the Occlusive Polyethylene Method (Hu et al., 2018). Plastic bags can reduce heat loss through evaporation and radiation, thereby increasing the baby's body temperature (Rohana et al., 2011). With creating an isolated environment, plastic bags help prevent hypothermia in LBW infants by minimizing heat loss through evaporation, radiation, conduction, and convection (Tourneux et al., 2017). At Tidar Hospital in Magelang City, LBW infants are treated to prevent heat loss using standard procedures, including the use of infant warmers and incubators. All LBW infants are initially placed under an infant warmer for 10-15 minutes before being transferred to a pre-warmed incubator. While this care is effective in the hospital setting, some parents may struggle to maintain their baby's temperature at home, particularly without access to an incubator. Educating parents on simple and effective methods, such as the use of plastic bags or skin-to-skin contact, can help them manage their LBW infant's temperature and prevent hypothermia at home.

Case Description

After conducting a comprehensive assessment, the author analyzed the data and determined a nursing diagnosis of hypothermia related to a lack of subcutaneous fat in a low birth weight (LBW) infant weighing 1560 grams. The infant required care in an incubator and exhibited objective signs of hypothermia, including a body temperature of 35.3°C, cold extremities, a pulse rate of 137 beats per minute, and a respiration rate of 40 breaths per minute. The aim of the nursing plan is to improve thermoregulation in the infant, with outcome criteria including improved body temperature and skin temperature. The nursing plan includes providing a warm environment and using occlusive polyethylene bags to prevent heat loss. To implement this intervention, the nurse will identify LBW infants at risk for hypothermia, measure their body temperature using an appropriate thermometer, and ensure their general condition is stable. The nurse will then prepare the necessary equipment, including a clean and dry clear polyethylene plastic bag and a baby hat, and place the infant in the bag, covering their body, legs, and neck. The top of the bag will be closed around the neck to prevent air from entering, and the infant's body temperature will be monitored regularly. The goal of this nursing plan is to maintain a stable body temperature in the LBW infant and prevent further heat loss. By implementing these interventions, the nurse can help improve the infant's thermoregulation and overall health outcomes. The effectiveness of the nursing plan will be evaluated by monitoring the infant's body temperature and skin temperature regularly, and any changes in the infant's condition or temperature will be documented and used to adjust the nursing plan as needed. LBW infants are at increased risk for hypothermia due to their limited ability to regulate body temperature. The use of occlusive polyethylene bags has been shown to be effective in reducing heat loss and improving body temperature in LBW infants. By providing a warm environment and using occlusive polyethylene bags, nurses can help promote thermoregulation and reduce the risk of complications associated with hypothermia. This nursing plan is crucial in ensuring the infant receives the necessary care to prevent long-term health consequences.

Discussion

The difference in body temperature of LBW babies before and after using the occlusive polyethylene method was a temperature difference of 1.8°C, the temperature before 35.3°C and the temperature after 37.1°C. Based on these data, it can be seen that the occlusive polyethylene method can be considered effective in increasing the temperature of LBW. Babies who have been treated with the occlusive polyethylene method for 2 hours are able to have a warm temperature for 30 minutes, after which the baby is put in an incubator to keep the baby's body temperature warm. The occurrence of evaporation or evaporation in the baby's body which is placed in a plastic bag causes LBW babies to not experience hypothermia, because the dysfunction of water molecules caused by sweat fluid which turns into gas causes evaporation which causes a feeling of warmth, so that the warm temperature will be trapped in the plastic bag and no environmental temperature will enter. The occlusive polyethylene method is a technique for preventing hypothermia and has been proven effective in several studies. Plastic will reduce heat loss due to evaporation and the possibility that radiation cannot pass through the plastic barrier so that it can increase the baby's temperature. Apart from that, the wrapped plastic bag will be airtight so it will prevent heat loss through evaporation, radiation, conduction, convection so that it will produce heat and increase the temperature.

The main diagnosis of the patient is hypothermia. Based on this diagnosis, a nursing plan is prepared to overcome the problem according to the goals and criteria for the results to be achieved. The preparation of nursing plans (interventions) and outcome criteria for clients refers to the SIKI and SLKI which are the basis for the process of providing nursing care. Meanwhile, interventions to treat hypothermia are monitoring body temperature, monitoring blood glucose periodically, providing a warm environment and administering the occlusive Polyethylene. Administering the occlusive Polyethylene method can improve or maintain thermoregulation in LBW babies. Studies explained that the administration of the occlusive Polyethylene method had an effect on the temperature of LBW babies (Duman et al., 2006; Shafie et al., 2017; Leadford et al., 2013). The implemented interventions include hypothermia management and occlusive polyethylene treatment. From the moment the client arrives at the hospital until the baby is transferred to the neonatal care unit, treatment is provided using plastic wrap or occlusive polyethylene to support thermoregulation. This method is based on the standard procedure for LBW care at Tidar Regional General Hospital.

The plastic wrap acts as a protective barrier between the infant's skin and the external environment, minimizing direct exposure to cold air and preventing the evaporation of body fluids that could lead to a drop in body temperature. The nursing actions carried out by the author were generally aligned with the established nursing care plan. Additionally, the author received support from the family, which served as a positive contributing factor during this stage of care.

In this case, the author evaluated the success of nursing care by comparing the outcomes with the predetermined criteria established in the care plan. The evaluation focused on the progress and effectiveness of nursing interventions throughout the implementation of the care program. One of the primary issues addressed was thermoregulation in neonates outside the incubator, which was successfully managed using the occlusive polyethylene method. From the first day of the infant's arrival until transfer to the Cempaka Room, the use of occlusive polyethylene demonstrated a positive impact on body temperature regulation. On the first day, the infant's body temperature increased from 35.3°C before the intervention to 37.1°C afterward. On the second day, the temperature rose from 36.2°C to 37.3°C following the same intervention. The occlusive polyethylene method serves as an effective alternative for neonatal care in situations where an incubator is unavailable. It can also be applied at home for infants discharged with a birth weight of less than 2500 grams. In addition to being cost-effective, this method significantly reduces the risk of hypothermia and supports safe thermal management in low-resource settings.

Conclusion

The occlusive polyethylene method is a simple yet effective intervention for treating hypothermia in LBW infants. With wrapping the infant in a clear polyethylene bag, heat loss is minimized, and the infant's body temperature can be maintained or even increased. This method is particularly useful in resource-limited settings where access to incubators or other warming devices may be limited. The occlusive polyethylene method has been shown to be a safe and effective way to prevent and treat hypothermia in LBW infants, and its use can contribute to improved health outcomes and reduced morbidity and mortality in this vulnerable population. For future research, it is recommended to investigate the optimal duration and frequency of occlusive polyethylene bag use, as well as its effectiveness in different clinical settings and in combination with other interventions, such as kangaroo mother care, to further inform evidence-based practice and improve outcomes for LBW infants.

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