

Review of Hypothermia with Low Birth Weight

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Abstract: *The first 28 days of life – the neonatal period – are the most vulnerable time for a child's survival. Neonatal mortality is directly related to birth weight and gestational age. One of the complications related to intrapartum is low birth weight and preterm birth. At birth, the neonate rapidly cools in response to the relatively cold extrauterine environment. In order to survive, the neonate must accelerate heat production via non-shivering thermogenesis (NST), which is coupled to lipolysis in brown adipose tissue. Brown adipose tissue helps maintain thermoregulation and warm the neonate, but this tissue is either less developed or present in smaller amounts in low birth weight or premature babies. Therefore, hypothermia is one of the main causes of neonatal mortality. After delivery, skin-to-skin contact is very important for preventing hypothermia in the relatively cold extrauterine environment. Thus, the objective of this review is to explore methods to prevent hypothermia in low birth weight babies. Kangaroo Mother Care (KMC) is one way to maintain warm chain and protect infants from the extrauterine environment. Proper nutrition, hygiene, and KMC can prevent hypothermia and sepsis in babies, improve weight gain, and develop adipose tissue, which maintains thermoregulation.*

Keywords: LBW, Thermoregulation, Hypothermia, KMC, STS (skin-to-skin), Non-shivering thermogenesis (NST), Brown fat.

1. Introduction

A neonate with a birth weight less than 2500g, irrespective of gestational age, is termed as a low birth weight (LBW) baby. Both preterm and small for dates (SFD) or intrauterine growth restriction (IUGR) babies are considered LBW babies. Hypothermia is considered a silent killer in neonates, as it increases neonatal mortality and morbidity. Maintaining warmth in neonates enhances their survival. Hypothermia is a common alteration of the thermoregulatory state of neonates. The normal body temperature is between 36.5°C and 37.5°C, and hypothermia occurs when the body temperature drops below 36°C. Various factors are responsible for neonatal hypothermia, such as the change in temperature from the womb to the cooler extrauterine environment, inadequate warming procedures before and during the transport of the baby, excessive heat loss by evaporation, conduction, convection, and radiation, from a wet baby to cold linen, cold room, and cold air. High-risk neonates, such as LBW babies, those with birth asphyxia, and those with congenital malformations, are particularly vulnerable to heat loss due to factors such as a large body surface area per unit of body weight, a large head, underdeveloped immunity of the heat regulation center, poor insulation due to less subcutaneous fat in LBW babies, and reduced brown adipose tissue (BAT) as a heat source (1, 2).

Thermoregulation is important for both term and preterm neonates as they transition from intrauterine life to extrauterine life. In fetal life, the placenta acts as a heat exchanger from the mother, but after birth, the baby must maintain and produce heat for itself. The mechanism of heat production in neonates is known as nonshivering thermogenesis (NST), and the site of heat production is brown adipose tissue (BAT). When heat loss begins, thermoreceptors in the subcutaneous tissue, spinal cord, and hypothalamus are stimulated, triggering NST. Noradrenaline released from the sympathetic nervous system acts on brown fat and helps in heat production. In full-term neonates, BAT accounts for 4% of total fat, which is less in LBW neonates.

Heat loss occurs through evaporation, conduction, convection, and radiation. Evaporation occurs immediately after birth if the baby is not dried and covered adequately. If the humidity of the room remains low, evaporation heat loss increases from exposed areas of the neonate. Conduction occurs with direct contact with cooler objects or surfaces (e.g., cold tables, mackintosh, towel tray, etc.). Convection occurs when the baby is placed in cooler air and air movement is present (e.g., an open window, fan, etc.), and radiation occurs when the infant loses heat to cooler objects.

Hypothermia occurs immediately after birth in preterm neonates, and it also occurs often as a consequence of efforts to provide thermal support. Both hypothermia and hyperthermia are potentially harmful. Similar types of various studies have shown that gestational age affects preterm and very low birth weight neonates, and it is inversely related to the risk of hypothermia and to the time required for recovery to normothermia. It was also investigated the incidence of admission hypothermia in very low birth weight (VLBW) infants and to determine the association of admission temperature with in-hospital mortality and morbidities. (3,4).

Caldas et al. conducted a study about effectiveness of a measured program to prevent admission hypothermia in very low-birth weight preterm infants. The study was to evaluate the effectiveness of a thermoregulation bundle for preventing admission hypothermia in very low-birth weight preterm infants. The study found that the incidence of admission hypothermia was significantly reduced in the post-implementation intervention. No differences were observed regarding birth weight and gestational age. There was a very important reduction in the incidence of admission hypothermia and a higher median admission temperature after continued protocol implementation (5).

Early skin-to-skin contact (SSC) is of utmost importance and is a good practice after birth to prevent hypothermia in both term and preterm neonates. Various similar studies have

found that it decreases the incidence of hypothermia for the initial 48 hours of life. Early SSC should be aggressively promoted in term and late-preterm newborns to reduce the incidence of hypothermia (6,7). Other studies have also stated that the effect of SSC improves breastfeeding sucking competence and prevents early hypothermia in neonates, leading to increased maternal satisfaction, breastfeeding rates, and better temperature control and weight patterns. Additionally, it has been noted that skin-to-skin contact between mother and infant is possible after delivery via cesarean section and does not increase the risk of hypothermia (8, 9, 10, 11).

Kangaroo Mother Care (KMC) is also an important measure to warm both low birth weight and preterm neonates, especially when they are being transported from one ward to another. Various similar types of studies have found that KMC can provide optimal thermoregulation in low birth weight babies during transportation. KMC can also be given by other members of the family and has been shown to increase the infants' body temperature. After discharge, in-home care management is also essential for improving weight (12,13,14,15). When compared with term and preterm low birth weight babies, KMC practiced as much as possible improves thermoregulation and prevents moderate hypothermia in low birth weight infants (16,17)

Moderate hypothermia is common in premature or very low birth weight neonates. Various studies have evaluated that immediate shifting to the intensive care unit after birth improves the morbidity and mortality rate. Simple interventions, such as maintaining room temperature above 25°C, reducing maternal hypothermia prior to delivery, providing plastic bags/wraps and caps for newborn infants, and using warm resuscitation gases, may decrease hypothermia at NICU admission and improve early neonatal survival (18,19,20)

2. Discussion

Hypothermia is one of the causes of the infant mortality rate. Various study findings have shown that early prevention of hypothermia decreases the morbidity rate of neonates. Early skin-to-skin contact is very important for neonates to adjust to the outer environment and also facilitates psychological attachment between mother and neonate, where the neonate does not feel insecure. Hypothermia often occurs in the first minutes after birth in preterm infants and can be potentially harmful. Similar studies have indicated that very preterm infants, regardless of clinical stability, do not develop hypothermia during immediate skin-to-skin contact after birth. Immediate skin-to-skin contact also protects against events of hyperthermia. Concerns about thermal regulation should not limit the implementation of immediate skin-to-skin contact in high-resource settings. Delivery room management should also be focused on the adaptation of the infant, as well as early interventions that improve long-term outcomes emphasizing the "golden hour" of care for this extremely vulnerable population. Implementation of thermoregulatory interventions best suited to local settings can significantly reduce neonatal hypothermia, which, in turn, can help improve neonatal outcomes (21,22). After delivery, premature or low birth weight babies with

hypothermia may experience adverse effects in their future, such as immature neurodevelopment, respiratory distress syndrome, and an increased susceptibility to sepsis in the hospital, leading to higher morbidity rates (23).

Kangaroo mother care is one of the preventive methods for the prevention of hypothermia. When preterm, premature, or low birth weight babies are discharged, KMC helps with thermoregulation in home care management. In hospital step-down rooms, mothers are taught about KMC. Not only mothers but also all family members can provide KMC. Similar types of various studies have shown that low birth weight neonates receiving KMC exhibit optimal thermoregulation, while a high incidence of moderate hypothermia is observed among neonates receiving conventional care during transport. KMC practiced as much as possible in combination with standard thermoregulation care, initiated either at birth or 1 hour after birth, did not reduce moderate or severe hypothermia in term infants compared to standard thermoregulation care.

3. Conclusion

So, based on the above discussion of the review, hypothermia emerges as one of the main risk factors for infant mortality or morbidity rates, particularly affecting low birth weight and premature or preterm neonates. Thermoregulation is crucial for both term and preterm neonates as they have to adapt from intrauterine to extrauterine life during transition. Brown adipose tissue (BAT) plays a significant role in maintaining thermoregulation, which is relatively less in low birth weight babies. Early skin-to-skin contact and continued KMC help improve the baby's warmth and assist in thermoregulation. Not only the baby warm it also help a good attachment with mother and baby which have not feel the baby in secured and have a psychological support. Healthcare staff should also closely observe and be aware of special care requirements for premature or LBW neonates, such as ensuring they are adequately covered with warm clothes, monitoring body temperature, keeping them away from cooler objects, and educating mothers about KMC, among other measures. Health education and life demonstration of KMC is one the best process to improve the care of premature neonates or low birth babies and also after discharge in home care management its very needful.

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