

Reducing the incidence of hypothermia in premature neonates during transfer

ABSTRACT

The mortality rate of premature babies with hypothermia is 3.64 times higher than that of babies with normothermia. In this project we aim to reduce the incidence of hypothermia in premature neonates upon transfer. Prior to this study, the rate of premature baby body temperature lower than 36.5°C is 40% at the one-hour post-transfer measurement. After careful analysis, we determined the main reason to be rapid heat loss when opening the incubator. Hence, administration of a transparent PVC material covering on the inside of the incubator was proposed, so that heat loss can be decreased upon opening of the incubator. After implementation of this method, not only did the incubator remain at 38°C at the first hour post-transfer, but the time for incubator temperature to drop to 32°C extended from 46 seconds to 5 minutes and 24 seconds. In addition, the rate of hypothermia of less than 36.5°C in premature babies during the first hour post-transfer decreased from 40% to 25%, thus proving the effectiveness of our method.

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INTRODUCTION

The World Health Organization defines premature babies as newborns delivered at 20-36 weeks of gestation. Normothermia is a temperature between 36.5-37.5 degrees Celsius and a core body temperature below 36.5 °C defined as hypothermia (WHO, 2017). Hypothermic status in premature neonates tend to increase oxygen consumption, cause peripheral blood vessel contraction, and increased the incidence of hypoglycemia, metabolic acidosis, respiratory distress, acute renal failure and other serious complications, resulting in increased overall mortality (Knobel and Davis, 2010). The faster the air flow, the more heat dissipated, and cooler temperatures accelerate the convection process to take away more heat. Hence, it is important to maintain normal core body temperature within one hour of delivery during care and transfer of premature babies and to avoid hypothermia (Bissinger and Annibale, 2010). After delivery in the delivery room, the premature baby will be transferred to our neonatal intensive care unit (NICU) in transfer incubator. However, in clinical practice, heat loss through dissipation occurs when the incubator is opened, making it more difficult to maintain the baby's core temperature during transfer. We proposed this method to improve care for premature babies.

METHODS AND MATERIALS

1. In our institution, the delivery room is located on the 3rd floor, and the NICU is located separately on the 5th floor. Vertical transfer is the preferred transfer mode for high risk neonates, using a transfer type incubator to reduce complication rates and increase survival rates, and the transfer process takes about 5-8 minutes.
2. During transfer, the act of reaching in the incubator to secure the tubing may cause heat loss through dissipation through the open compartment, causing the interior temperature of the incubator to decrease. We also attempted to pre-warm the transfer type incubator to 38°C, however, upon opening the windows, it only took 46 seconds for the incubator temperature to drop to 32°C. Re-warming the incubator requires 6 minutes for increasing 1°C.

METHODS AND MATERIALS

3. Our idea originated from open air refrigerators from supermarkets and convenience stores. We designed a transparent covering made of PVC material attached on the interior of the incubator as shown in the pictures so that when the hood opens, the heat would not dissipate as quickly as before. When the medical staff is placing the premature neonate into the incubator, care must be taken to just retract the arm and not to lift the plastic covering, to avoid excess heat loss.

RESULTS

We measured the incubator temperature before and after applying this plastic covering. First, we pre-warmed the incubator to 38°C. Then, we opened the hood and observed that without this covering, it took 46 seconds for the incubator temperature to decrease to 32°C, but with this covering, it increased to 5 minutes and 24 seconds. Next, we assessed the time it took for reduction for each degree of temperature. Before applying the plastic PVC covering, it took 10 seconds for a temperature decrease from 38°C to 37°C, 16 seconds from 37°C to 36°C, and 20 seconds from 36°C to 35°C. However, after applying the plastic PVC covering, the time range increased to 45 seconds, 1 minute and 35 seconds, and 3 minutes and 4 seconds, respectively, and very effective for delaying heat loss.

GRAPHS AND TABLES

Year	2019(before) N=10	2020 (after) N=12
Normothermia \geq 36.5	6(60.0%)	9(75%)
Hypothermia $<$ 36.5	4(40.0%)	3(25%)
Rate of hypothermia	40%	25%



DISCUSSION

The hypothermia rate in premature neonates has greatly decreased, but there is still room for improvement. Also, close follow up and more data is required to assess for decreased morbidity and mortality rates.

CONCLUSIONS

The body temperature of a premature baby is an important factor that requires a multidisciplinary team care, and a good creative team can bring this baby better care quality and future prognosis.

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