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Prevalence of Hypothermia among Low Birth Weight Neonates in a Tertiary Care Center in India

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ABSTRACT

Objective: To assess the incidence of hypothermia in low birth weight neonates (weighing <2000g) using a novel device that continuously monitors temperature and alerts when there is hypothermia. To compare the incidence of hypothermia among different gestational age and weight categories.

Methods: This descriptive study was done in the step-down nursery of a tertiary care hospital in India. Low birth weight neonates were monitored for hypothermia using a novel device (Bempu TempWatch) for a period of 24 hours. The device displayed blue color when the neonate was normothermic and alarmed with orange light when the neonate was hypothermic. A digital axillary thermometer was used to crosscheck the temperature alarm of the device.

Results: A total of n=418 neonates were screened for hypothermia. Hypothermia was observed at least once in 24 hours among 69.8%, 64.7%, and 45.7% of very preterm, moderately preterm, and term neonates respectively and it was noted in 70.4%, and 58.5% of very low birth weight and low birth weight neonates.

Conclusion: Incidence of hypothermia was higher among preterm and low birth weight babies but also in low birth weight term babies, indicating that round the clock monitoring is essential for all babies in the step-down nursery. Hence, a continuous monitoring device like TempWatch may be beneficial in the early detection of hypothermia.

Keywords: Hypothermia, low birth weight, Preterm, Neonates, Device

INTRODUCTION

In India, neonatal mortality is high (24 per 1000 live births). [1] Data suggests that hypothermia is a leading cause of neonatal morbidity and mortality. [2] World Health Organization (WHO) defines hypothermia as the reduction in mean body temperature below 36.5 °C. [3] Hypothermia may not be the direct cause of infant death but it increases the neonate's risk of morbidity and mortality from infections, prematurity and birth asphyxia. [4] As the temperature regulation mechanism is not fully developed in neonates, they are more susceptible to hypothermia. Untreated hypothermia may have consequences such as hypoglycemia and poor weight gain. [5]

In order to ensure that the neonate's basal metabolic rate is minimal for it to thrive well, its temperature should be maintained between 36.5 °C to 37.5 °C. In hospital settings, especially Neonatal Intensive Care Unit (NICU), the thermoneutral environment is maintained by keeping the neonates in warmers and incubators. [6] However, once shifted to the step down nursery or postnatal ward, which resembles the home environment, neonates are at a higher risk of becoming hypothermic. Lack of continuous monitoring may lead to hypothermia going undetected. Low income countries often have limited facilities for thermal monitoring and protection of neonates. This establishes a need for an accurate, simple and easy to understand device that aids the mother in continuous monitoring of temperature during the neonate's hospital

stay in a step down nursery and also in the home setting after discharge.

The Bempu bracelet, or TempWatch, is a silicone band with a thermistor metal cup that provides 24/7 protection against neonatal hypothermia (Figure 1). The bracelet continuously monitors for one month after activation and shows a blue light for a normal temperature. It blinks with an orange light and sounds an alarm when the neonates core temperature falls below 36.5℃ indicating hypothermia. It has a sensitivity and specificity of 98.6% and 95% respectively, making it a reliable tool to help assess the prevalence of hypothermia. [7]

This study was done to assess the incidence of hypothermia among low birth weight neonates in a tertiary care center and quantify its occurrence in relation to post-menstrual age and birth weight.

MATERIALS AND METHODS

This descriptive study was conducted in the Department of Neonatology in a tertiary care hospital, south India between January to June 2016 after approval by the Institutional Ethics Committee. All neonates born with low birth weight and weighing less than 2000 grams in the step-down nursery were enrolled into the study after taking written informed consent from the parent. A step-down nursery is an intermediate unit of NICU which resembles home environment, where breastfeeding and Kangaroo Mother Care (KMC) is encouraged in mothers to maintain normal temperatures in the neonates.

Data on neonates' birth weight, gestational age and sex were collected at enrolment. TempWatch was put on the wrists of all the neonates at recruitment ensuring a snug fit. The neonates temperature was cross-checked at the axilla with a digital thermometer for every hypothermic alarm (displaying orange light) by the TempWatch. We collected all the data with regard to hypothermia in these neonates for a period of 24 hours using this device. The sensitivity and specificity of the wrist band in diagnosing hypothermia is 98.6% and 95% respectively. [7] Additionally, the baby's temperature was also checked when it was normothermic i.e > 36.5℃ (the TempWatch displayed blue light) 4 times a day. To address hypothermia incidents (i.e. TempWatch displayed orange light with alarm), corrective measures like KMC and incubator care were undertaken under the staff supervision till the TempWatch showed a blue light again. This revival was cross-checked by measuring axillary temperature using a thermometer. The reference standard was the axillary temperature measured using digital thermometer by staff nurse after every 6 hours. Based on variables like post-menstrual age, weight at the time of enrolment and gender, the incidence of hypothermia in various groups was analyzed.

Statistical Methods: The total sample size analysed was n=418 low birth weight (i.e birth weight less than 2000g) neonates (post-menstrual age > 37 weeks= 35; post-menstrual age < 37 weeks= 383). The power of the study was 80% when alpha was kept at 0.05. Data was analyzed using both descriptive and inferential statistics. The continuous variables were expressed as mean with standard deviation while categorical data were expressed as frequencies and percentages. We used the MedCalc software (https://www.medcalc.org/calc/comparison_of_proportions.php) to test the statistical significance of differences between parameters. [8, 9]

RESULTS

The neonatal characteristics are described in Table 1. The hypothermia incidence was 57.4%. Hypothermia was noted at least once in 24 hours among 270 (64.6%) neonates. Among term neonates 45.71% had hypothermia at least once in 24 hours. Among preterm neonates 66.3% were hypothermic at least once in 24 hours. There

was a significant difference (p=0.01) for hypothermia incidences (at least once in 24 hours) among the two groups (i.e. Term Vs Preterm). The results are summarized in Table 2 and Figure 2.

Table 1: Neonatal Characteristics

Neonatal Characteristic	Distribution (n)
Postmenstrual age	
Very Preterm (VPT): 28-32 weeks	116
Moderately Preterm (MPT): 33-36 weeks	267
Term: >=37 weeks	35
Weight at Enrolment	
Very Low Weight (1000-1499g)	196
Low weight (1500-2000g)	222
Gender	
Male	302
Female	116

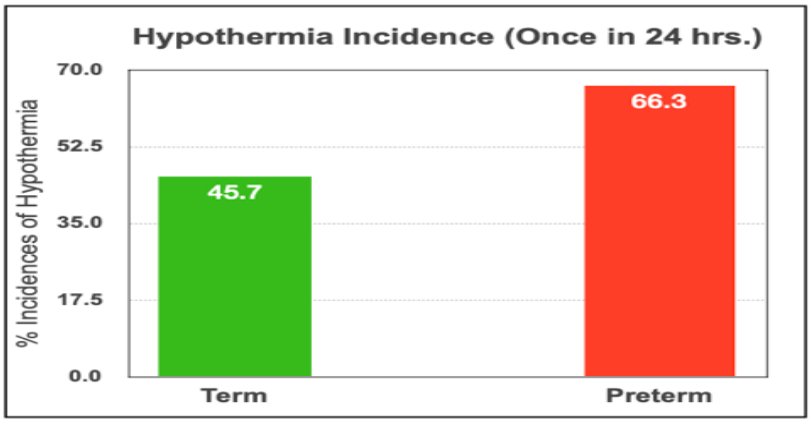
Table 2: Hypothermia Incidence (at least once in 24 hrs) in Neonates Classified based on Gestation and Weight at Enrolment

Groups	Hypothermia Incidence (%)
Based on Gestation Age at Enrolment	
Very Preterm (VPT)	69.8
Moderately Preterm (MPT)	64.7
Term	45.7
Based on Weight at Enrolment	
Very Low Weight	70.4
Low weight	58.5

The preterm neonates (n=383) were further classified as Very Preterm (n=116) and Moderately Preterm (n=267) based on their gestation age at enrolment. The incidence of hypothermia at least once in 24 hours was 69.8% in Very Preterm and 64.7% in Moderately Preterm. The results are summarized in Table 2.

The total n=418 were grouped as Very Low weight (n=196), Low weight (n=222) neonates. Hypothermia at least once in 24 hours was 70.4% in Very Low weight babies and 58.5% in Low weight babies. The results are summarised in Table 2.

Figure 1: The Bempu Hypothermia Alert Device (TempWatch)



Comparison of Proportion Test for Hypothermia in two groups (Term Vs Preterm)	
Difference	20.6%
95% CI	3.7809% to 36.5113%
Chi-squared	5.935
DF	1
Significance level	P = 0.0148

Figure 2: Hypothermia Incidences in Preterm and Term Neonates

DISCUSSION

Hypothermia is one of the major risk factors for co-morbidities and mortality among low birth weight infants. In India, the occurrence of hypothermia is estimated to be 31% in the community setting [10] and 32% in hospital setting. [11] The incidences of hypothermia (at least once in 24 hours) in the recruited neonatal population were much higher (64.6%) than expected in a step down

nursery. This study was done under continuous monitoring using TempWatch which was also crosschecked by staff nurses at 6-hour intervals. Thus, continuous monitoring may have resulted in a higher detection of hypothermia which translated into higher prevalence of hypothermia. Commonly, hypothermia remains undiagnosed and untreated due to a lack of continuous monitoring. The above results highlight the need for a device that accurately and continuously monitors for hypothermia thus preventing undiagnosed hypothermia events in neonates.

In the present study, the highest incidences of hypothermia were recorded in the very preterm (69.8%) and very low weight neonates (70.4%) at least once in 24 hours. This may lead to higher susceptibility of developing co-morbidities due to lack of early detection of hypothermia in lower birth weight and younger babies. Similar results have been published from other countries with low income settings. [4, 12, 13] The results of our study emphasize the need for continuous monitoring of neonates for hypothermia incidences in a step down nursery. The current data for incidences of hypothermia (at least once in 24 hours) also indicates that neonates who have low birth weight but born at term have hypothermic episodes (at least once in 24 hours) as high as 45.71%. This percentage of hypothermia incidences was higher than expected for babies who have progressed to term. The results therefore suggest that additional care should be taken to monitor low weight term neonates for hypothermia in the step down nursery and even at home.

Majority of the alerts (verified by nurses) were of temperatures between 36-36.5 ℃ (mild hypothermia). However, we speculate that a proportionate of these would have extended into moderate or severe hypothermia. Therefore, an easy to use continuous temperature monitoring tool is essential for the early detection and treatment of hypothermia, which will eventually decrease neonatal mortality rates and improve the neonates' outcomes.

The present study has few limitations; 1) it was performed in a hospital setting 2) the core temperature for neonates was not measured. However, results from our earlier study carried out in a community setting indicated that most mothers used corrective measures like KMC when hypothermia was detected on continuous temperature monitoring using the TempWatch. [14] Future large studies are in progress in the community settings that will support the current observed findings. Further studies are also needed to clarify mortality rates, NICU readmission rates, and weight gain post discharge in infants monitored using TempWatch.

CONCLUSION

Incidence of hypothermia was higher among preterm and low birth weight babies but also in low birth weight term babies, indicating that round the clock monitoring is essential for all babies in the step-down nursery. Hence, a continuous monitoring device like TempWatch may be beneficial in the early detection of hypothermia.

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REFERENCES

1. Sankar MJ, Neogi SB, Sharma J, et al. State of newborn health in India. Journal of Perinatology, 2016; 36(s3), S3.
2. Knobel-Dail RB. Preventing hypothermia in preterm infants: a program of research. Rwanda Journal, 2015; 2(2), 57-61.
3. Yip WY, Quek BH, Fong MCW, et al. A quality improvement project to reduce hypothermia in preterm infants on admission to the neonatal intensive care unit. International Journal for Quality in Health Care, 2017; 29(7), 922-928.
4. Lunze K, Bloom DE, Jamison DT, et al. The global burden of neonatal hypothermia: systematic review of a major challenge for

newborn survival. BMC medicine, 2013; 11, 24.
5. Kumar V, Shearer JC, Kumar A, et al. Neonatal hypothermia in low resource settings: a review. Journal of Perinatology, 2009; 29(6), 401.
6. McCall EM, Alderdice F, Halliday HL, et al. Interventions to prevent hypothermia at birth in preterm and/or low birth weight infants. The Cochrane database of systematic reviews, 2018; 2(2), CD004210.
7. Tanigasalam V, Vishnu Bhat B, Adhisivam B, et al. Hypothermia detection in low birth weight neonates using a novel bracelet device. The Journal of Maternal-Fetal & Neonatal Medicine, 2019; 32(16), 2653-2656.
8. Campbell I. Chi-squared and Fisher–Irwin tests of two-by-two tables with small sample recommendations. Statistics in medicine, 2007; 26(19), 3661-3675.
9. Richardson JT. The analysis of 2× 2 contingency tables- Yet again. Statistics in medicine, 2011; 30(8), 890-890.
10. Agarwal S, Sethi V, Srivastava K, et al. Human touch to detect hypothermia in neonates in Indian slum dwellings. The Indian Journal of Pediatrics, 2010; 77(7), 759-762.
11. Nimbalkar SM, Patel VK, Patel DV, et al. Effect of early skin-to-skin contact following normal delivery on incidence of hypothermia in neonates more than 1800 g: randomized control trial. Journal of Perinatology, 2014; 34(5), 364
12. Demissie BW, Abera BB, Chichiabellu TY, et al. Neonatal hypothermia and associated factors among neonates admitted to neonatal intensive care unit of public hospitals in Addis Ababa, Ethiopia. BMC pediatrics, 2018; 18(1), 263.
13. Zayeri F, Kazemnejad A, Ganjali M, et al. Incidence and risk factors of neonatal hypothermia at referral hospitals in Tehran, Islamic Republic of Iran. 2007.
14. Sharma M, Morgan V, Siddadiah, et al. Impact on Death of Low Birthweight Babies at Four Weeks: A Non-randomized Controlled Community-based Trial. Indian Pediatrics. 2019 (In Press)

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