

Incidence and Risk Factors for Neonatal Hypothermia at Presentation

Anand Bhatia^{1*}, Anshuman Srivastava², Utkarsh Sharma³, Rajul Rastogi⁴

¹PG Resident, ²Associate Professor, ³Professor & Head, Department of Pediatrics,

⁴Assistant Professor, Department of Radiodiagnosis,

Teerthanker Mahaveer Medical College and Research Centre, Moradabad, Uttar Pradesh, India.

ABSTRACT

Background: Hypothermia is a significant cause of neonatal morbidity & mortality in developing countries like India and is associated with variety of causes many of which are preventable.

Introduction: As neonatal hypothermia is rampant in our socioeconomic conditions, hence we want to emphasize the importance of its prevention by maintaining warm chain and controlling other factors that lead to hypothermia.

Material & Methods: Present study included 100 neonates presenting to our department for presence of hypothermia with further evaluation of associated factors showing their statistical significance.

Results and Conclusion: Present study revealed that neonatal hypothermia though common in our set-up yet the causes underlying it are preventable by maintaining warm chain before and after the delivery of child, managing co-morbid conditions and training of medical personnel.

Keywords: Neonate, Hypothermia, Low Birth Weight, Hyperbilirubinemia, Meconium Aspiration Syndrome.

*Correspondence to:

Dr. Anand Bhatia,
PG Resident,
Department of Pediatrics,
Teerthanker Mahaveer Medical College & Research Centre,
Moradabad, Uttar Pradesh, India.

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INTRODUCTION

Hypothermia is defined as temperature of less than 36.5°C (97.7°F) in a newborn with normal range of temperature being 36.5 – 37.5°C. The major risk factors in neonate for developing hypothermia are low birth weight and prematurity. Hypothermia is a serious medical problem responsible for high perinatal mortality in developing world. Preterm neonates are more exposed to procedures like intubations, umbilical line insertion or exchange transfusion making them susceptible for heat loss. Preventing hypothermia help reduce the risk of sepsis and subsequent morbidity in newborn.¹

Around 1 million newborn infants' deaths occur every year before completing first four weeks of life. The infant mortality rate is of 44 per 1000 live births in which two thirds of the infant mortality is in India.² Proper education to the mother, nursing staff or health care workers may reduce the incidence of hypothermia³. Premature neonates can be prevented from hypothermia with polythene wraps especially in extremely low birth weight neonates in addition to using pre-warmed towels, radiant warmer.⁴

Preterm and extremely low birth weight babies are more prone to hypothermia in first 12 hours of life due to inefficient thermoregulation. Pre-warming the delivery room and using plastic bags helps in preventing hypothermia as after birth the body temperature of neonate drop at a rate of 0.1°C and 0.3°C per

minute for skin and core temperature.⁵ Inadequate knowledge of health care providers, hypothermia is still a significant cause of neonatal morbidity and mortality.⁶

Hence, this study aims at evaluation incidence of hypothermia in term as well as preterm babies along with various other risk factors associated with hypothermia like birth weight, gestational age, hypoxic-ischemic encephalopathy (HIE), sepsis, etc.⁷

AIMS & OBJECTIVES

- Incidence of hypothermia in neonate presenting at the time of admission at Teerthanker Mahaveer Medical College & Research Center of Moradabad district.
- To assess the risk factors for development of hypothermia in such newborns.

MATERIALS & METHODS

The study was done at the Neonatal Intensive Care Unit of our college. All the neonates coming to NICU were considered as out-born. One hundred neonates were included in our prospective cross sectional study. A low-reading digital thermometer was used to record the temperature from axillary region for a period of at least 3 minutes. All neonates were examined for gestational age by taking into account the last menstrual period of mother and

Modified Ballard Scoring system. Any form of systemic illness was recorded along with illnesses like hypoglycemia, meconium aspiration syndrome, respiratory distress syndrome, hyperbilirubinemia. Gestational age was recorded as less than or greater than 37 weeks while birth weight was recorded with electronic weigh machine with group division in to greater than 2500grams, 1500 – 2500 grams, 1000 – 1500 grams and less than 1000 grams. Sample size was calculated on the basis of following formula: $4PQ/L^2$, where P is the prevalence of hypothermia and Q is (100-P), L= 5%-20% allowable error.

Inclusion Criteria

- All out-born babies of both sexes admitted to NICU from birth to 168 hours of life.

Exclusion Criteria

- Babies born within our institution
- Hemodynamically unstable babies

The recorded data was analyzed using Excel Sheet. Stat Cal & Chi-Square test was used as test of significance. Statistical significance was established when P value was less than 0.05 or the relative risk is >1.

Table 1a: Distribution of Neonates in relation of presence of Hypothermia

Temperature	Number	Percentage %
Hypothermia	43	43.00%
Normothermia	57	57.00%
Total	100	100%

Table 1b: Distribution of Neonates in relation to degree of Hypothermia

Hypothermia	Number	Percentage %
Mild Hypothermia	28	65.11%
Moderate Hypothermia	12	27.90%
Severe Hypothermia	03	06.97%

Table 2: Hypothermia V/S Sex Incidence

Sex	Hypothermia	Normothermia	Total
Male	22	27	49
Female	21	30	51
Total	43	57	100

Table 3: Incidence of Hypothermia V/S Seasonal Variation

Season	Hypothermia	Normothermia	Total
Rainy, win	30	29	59
Summer	13	28	41
Total	43	57	100

Table 4: Incidence of Hypothermia V/S Gestation

Gestation	Hypothermia	Normothermia	Total
> 37weeks	18	40	58
< 37weeks	25	17	42
Total	43	57	100

OBSERVATIONS AND RESULTS

Out of 100 babies admitted to NICU, 43 (43.00%) were found hypothermic at the time of admission with majority showing mild degree of hypothermia (Table 1a & b). Rest of the babies had normal temperature. Hypothermia was compared among both sexes. (Table 2) 44.89% of males were hypothermic when compared to 41.17% of female babies. When subjected to statistical analysis the results are found to be insignificant indicating that there is no sex preponderance.

Table 3 shows the preponderance of hypothermia during rainy + winter seasons is statistically significant as the risk ratio for hypothermia during rainy and winter seasons is more than 1 (Risk ratio of 1.03). When P value was calculated, it was 0.0572.

Incidence of hypothermia when correlated with GA among neonates as > 37 weeks and < 37 weeks, it was found that incidence of hypothermia was more in babies <37 weeks with p value 0.0045. (Table 4) This shows that there is a significant correlation of hypothermia with decrease gestational age.

When babies were categorized as < 2500gms and > 2500gms, incidence of hypothermia was found to be more in babies in former group with P value of 0.0432. (Table 5) The results are indicative of progressively increasing hypothermia with decrease in birth weight.

When babies were categorized based on their blood sugar levels of <45 mg/dl and >45 mg/dl, incidence of hypothermia was found

to be more in babies former group with P value of 0.0117. (Table 6) The results are indicative of the progressively increasing hypothermia with decrease in blood glucose levels. The babies were also categorized as meconium aspiration syndrome positive and negative. (Table 7) Out of the 16 % positive babies, 37.5 % (06) were hypothermic with the p value

0.6278 which is not statistically significant.

When the babies were categorized with NNH positive and NNH negative, out of 100, NNH was diagnosed in 25 neonates. (Table 8) Out of 25 babies, hypothermia was found in 76% (19) and the chi square was 14.810 with P value of 0.0001 which appears to be significant.

Table 5: Incidence of Hypothermia V/S Birth Weight

Gestation	Hypothermia	Normothermia	Total
> 2500gm	20	35	55
< 2500gm	23	22	45
Total	43	57	100

Table 6: Incidence of Hypothermia V/S Hypoglycemia

Blood Glucose	Normothermia	Hypothermia	Total
>45 mg/dl	43	22	65
<45 mg/dl	14	21	35
Total	57	43	100

Table 7: Incidence of Hypothermia V/S MAS

MAS	Normothermia	Hypothermia	Total
MAS positive	10	06	16
MAS negative	47	37	84
Total	57	43	100

Table 8: Incidence of Hypothermia V/S NNH (Neonatal hyperbilirubinemia)

NNH	Normothermia	Hypothermia	Total
NNH positive	06	19	25
NNH negative	51	24	84
Total	57	43	100

DISCUSSION

In our study the incidence of hypothermia was 43% in which mild and moderate hypothermia was 65% and 27%. A study done by Tinuade A ogunlesi et al.⁸ the incidence of hypothermia was 62% in which mild hypothermia was 47.3% and moderate came 52.7%. Lunze K et al.⁴ study prevalence range of hypothermia in hospital varies from 32% to 85% and in homes varies from 11% to 92%. Mullany LC et al.⁹ hypothermia was seen in 92.3% babies, half of the babies (48.5%) had moderate hypothermia and and it was morn in neonates born within 72 hours of life. Manji KP et al.¹⁰ study done in Tanzania 22.4% babies had hypothermia, 13 % of the hypothermic babies were having severe hypothermia. Hypothermia was significantly associated with deliveries that were from outside hospitals than those who had operative or instrumental delivery in the same hospital. Ali SR et al.¹¹ study was done in Aga Khan University Hospital, Karachi, Pakistan in which out of 300 neonates 44.5% were hypothermic. The frequency of hypothermia was found to be higher in low birth weight (LBW) 58.1% and preterm 64.2 % babies. Kaushik SL et al.¹² study was done for one year period where 2063 live births were taken and hypothermia was seen only in 2.9% (59).

The study conducted in our institution did not have any preponderance of any particular sex in developing hypothermia. Mullany LC et al.⁹ study done in southern Nepal where 23,240 babies were taken, hypothermia was more in female neonates who were breastfed after 24 hours of life and also in mothers who were hypothermic.

In our study the incidence of hypothermia was more in rainy and winter season with 50.84% as compared to 31.70% in summer season. Mullany LC et al.⁹ study in which out 23,240 newborns born between September 2002 to January 2006, 92.3% (21,359) babies had mild hypothermia, 48.5% had moderate to severe hypothermia which was more seen during the first 72 hours of neonatal life. For every 5°C decrease in average ambient temperature, risk of hypothermia was increased by 41.3% (95%CI). Mullany LC et al.⁹ noted that in the hot season the risk of disparity between <2.5 grams babies and larger babies increased. Kaushik SL et al.¹² study was done in which the incidence of hypothermia was observed to vary with seasons and was significantly higher in winter. From October to March (winters) the incidence was 3.9% (38/953) as compared to 1.9% (21/1110) from the month of April to September (summer) [p < 0.005].

Our study shows that hypothermia is more prevalent with decrease in gestational age decreases, 42% of neonates were <37 weeks and 59.52% of them were hypothermic. 65% of neonates were >37 weeks and among them 38.46% (25) were hypothermic. Similar study has been done by WHO¹, Njokanma OF et al.¹³, Manji KP et al.¹⁰, McCall EM et al.¹⁴, Xiao-Cheng J et al.¹⁵ have also conclusively explained in their studies that the more preterm the baby is the more likely evidence of hypothermia once emphasizing the need for transporting the preterm neonates in warm chain.

58% of neonates in our study were >2.5kg. Out of them, 20 neonates were hypothermia that is 36.36%. 38 neonates out of 100 were 1500gms to 2500gms and among them 47.36% (18) were hypothermic. The incidence of hypothermia increased proportional to the severity of preterm. Birth weight has got a time negative correlation and statistically significant simple regression analysis with hypothermia. Mullany LC et al.⁹ study for every 100gm decrement, hypothermia risk was increased by 7.4%, 13.5% and 31.3% for neonates between 3000grams and 2500 grams, 2500 grams and 2000 grams and <2000grams respectively. Njokanma OF et al.¹³ have also showed in their studies that more preterm the baby is the more likely probability of hypothermia once emphasizing the need for transporting the preterm neonates in warm chain. Similar studies using birth weight verses incidence of hypothermia were also obtained by Byaruhanga RA et al.¹⁶, Nayeri F et al.¹⁷, Da moto¹⁸, Kaushik SL et al.¹² The two most important crucial risk factors for hypothermia were low birth weight and preterm. The incidence of hypothermia still increases further with the decreasing gestational age as per Ballard score as they are more prone to heat loss and increase in risk for sepsis or asphyxia. Xiao – Cheng J et al.¹⁶ study done in Iranian newborns where 1952 newborns were taken which showed low birth weight babies are on higher risk for neonatal hypothermia.

Out of 43 babies who were hypothermic, 21 babies (60.00%) were hypoglycemic (blood glucose <45mg/dl). The incidence of hypoglycemia was more in babies who were hypothermic. The neonate utilize his glucose stores to keep warm, then the blood sugar drops which leads to hypothermia along with hypoglycemia. The relation between hypothermia and meconium aspiration syndrome is well known. In our study, out of 100, MAS was positive in 16%, out of which hypothermia was seen in 37.5% (06) babies. De Luca D et al.¹⁹ which is a international multicentric retrospective cohort study showed that whole body hypothermia reduces the lung inflammation and improves surfactant production and helps in meconium aspiration syndrome.

Our study shows higher incidence of hypothermia in relation to hyperbilirubinemia. Out of 100 neonates, 25 had hyperbilirubinemia, out of which 19 (76%) were hypothermic. Briend A, de Schampheleire et al.²⁰ study done in west Africa where 78 full term infants were taken showed that neonatal hypothermia is associated with hyperbilirubinemia.

LIMITATIONS

- Risk factors like sepsis and hypoxic ischemic encephalopathy that are also associated with neonatal hypothermia were not analyzed.
- As only out-born neonates were included in our study, the incidence of inborn neonates with hypothermia and

associated risk factors like leaking per vagina or sepsis while transferring the neonates to NICU was not analyzed.

CONCLUSIONS

1. Incidence of hypothermia is high in neonates presenting to our hospital (43.00%) without obvious sex predilection.
2. Higher incidence is noted in rainy and winter season compared to summer season.
3. Incidence of hypothermia is higher in premature & low birth weight neonates.
4. Hypoglycemia was seen more in neonates with hypothermia.
5. Hyperbilirubinemia is associated with hypothermia.
6. Our study emphasizes the need to strengthen warm chain services to newborn babies.

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