

The Incidence and Consequences of Neonatal Hypothermia in Babies Presenting to a Tertiary Care Hospital: An Observational Study

Incidence and Consequences of Neonatal Hypothermia

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Abstract:-

➤ Introduction:-

Neonatal hypothermia, a very well known and preventable neonatal condition which if overlooked can have severe consequences in neonatal outcome.

➤ Objectives:

1. To look for the incidence and severity of hypothermia in outborn neonates on admission
2. To compare their outcome with non hypothermic neonates.

➤ Methods:-

It is a hospital based observational study conducted in a tertiary level neonatal unit. Neonates were enrolled at admission. Ethical committee clearance and informed consent from guardians were taken. Temperature was recorded on arrival by probe of radiant warmer in right hypochondrium. Q Maternal and neonatal demographic details, neonatal clinical profile and outcome was recorded. Analysis was done by SPSS.16.

➤ Result:-

Total 261 neonates were admitted during the study period(term:178,preterm:83,ELBW: 2,VLBW: 11, LBW: 92).Out of this 117(44.8%) presented with hypothermia on admission,35(13.4%),55(21.1%)&27(10.3%) had severe hypothermia(<32°C),moderate hypothermia(32-35.9°C)& cold stress(36-36.4°C) respectively. All ELBW(100%),11(64.7%) VLBW, 53(57.6%) LBW,81(54%) >2.5KG babies had hypothermia(p=0.02).Amongst 83 preterm,50(60%)& amongst 178 term 67(37.6%) had hypothermia(p=0.019).In winter season(Dec, Jan) 103 babies came,84 babies came in milder climate (feb,march),72 babies came in summer(April, May) and 46(44.6%),34(40.4%) and 37(51.3%) had hypothermia respectively(p=0.042).Hypothermia was seen as comorbidity with shock(n=28) in 96.4%(n=27)(p=0.00), hypoglycaemia(n=28) in 89.2%(n=25)(p=0.00),neonatal sepsis(n=102) in 49%(n=50), birth asphyxia(n=59) in 50.8%(n=30)(p<0.001)and respiratory distress(n=27) in

51.8%(n=14) .Out of 54 neonates who expired 48(88.8%) babies had hypothermia and 26(48.1%), 21(38.8%) and 1(1.8%) had severe hypothermia, moderate hypothermia& cold stress respectively. Case fatality rate of hypothermic neonates with hypoglycaemia, shock& hypoxia were 60%,96.2% and 23.3% respectively.

➤ Conclusion:

44.8% neonates are admitted with hypothermia in tertiary units despite ongoing training of neonatal care. To reduce neonatal mortality thermal care in newborn should be given due importance.

Keywords:- Hypothermia, Newborn, Hypothermia Consequences.

I. INTRODUCTION

A newborn baby is homeothermic, but his ability to maintain his body temperature can be easily overwhelmed by environmental temperatures. Thermal protection of the newborn is a set of continuing measures, which starts at birth, to ensure that he maintains a body temperature of 36.5°C to 37.5°C. Mild hypothermia or cold stress is 36-36.4°C, moderate hypothermia is 32-35.9°C, severe hypothermia is <32°C and hyperthermia is >37.5°C. According to the NNPd 2002-2003⁽¹⁾, incidence of hypothermia among extramural babies was 18.4 %.

Neonatal hypothermia has been documented throughout the developing world in various study. It is a preventable neonatal condition which if overlooked can have severe consequences in neonatal outcome. It has been found to be an important cause of neonatal morbidity but the contribution of hypothermia to neonatal mortality is poorly understood. In case of neonatal transport thermal protection should be ensured. All the health care personnel involved in newborn care should be adequately trained and informed about the principles of warm chain. Studies on the incidence, severity and contribution of hypothermia to neonatal mortality is not done recently in India. This study was done to see incidence, severity and contribution of hypothermia to neonatal mortality in newborns who were either referred from other

health care facility or whose gaurdians reported themselves to a tertiary level hospital.

II. AIMS AND OBJECTIVES

1. To look for the incidence and severity of hypothermia in out-born neonates on admission
2. To compare their outcome with non hypothermic neonates that anticipate your paper as one part of the entire proceedings, and not as an independent document. Please do not revise any of the current designations.

III. METHODS AND MATERIALS

Place of study: the study was conducted in the neonatal unit of a tertiary Medical College in Assam

Study design: hospital based observational study

Duration of study: 6 months

Method of study: Neonates that attended the OPD or Emergency ward of the hospital and were admitted for different neonatal problems were enrolled at admission. Temperature was recorded by thermister probe. Informed consent was taken from the attendants. Ethical committee clearance was taken. According to the temperature recorded at admission babies were divided into the following categories:

- 1) Hypothermic- temperature <36.5°C. It was further subdivided into-
 - a) Cold stress- temperature between 36 – 36.4°C
 - b) Moderate hypothermia – temperature between 32 – 35.9°C
 - c) Severe hypothermia – temperature < 32°C
- 2) Normal- temperature between 36.5- 37.5°C
- 3) Hyperthermic- temperature >37.5°C

Variables studied were 1)Maternal factors (age of the mother and parity), 2)Neonatal factors (gestational age, birth weight and sex), 3) Environmental factors (a) Winter- if they presented in December and January, b) Normal climate- neither too cold nor too hot climate in February and March c) Summer- early part of summer season in they present in April and May.), 4) The prevalence of hypothermia in various disease manifestations a) Neonatal Sepsis- (i) Early onset neonatal sepsis without meningitis, ii) Early onset neonatal sepsis with meningitis, iii) Late onset neonatal sepsis without meningitis, iv) Late onset neonatal sepsis with meningitis.), b) Neonatal Jaundice, c) Birth Asphyxia (i) Birth asphyxia

with no HIE, ii) Birth asphyxia with HIE II, iii) Birth asphyxia with HIE III), d) Respiratory distress (i) Congenital pneumonia, ii) Hyaline membrane disease iii) Transient tachypnea of newborn, iv) Aspiration pneumonia, v) Meconium Aspiration Syndrome), e) Shock, f) Hypoglycaemia and hyperglycaemia

Outcome was studied under the following headings:

- a) Percentage of expired babies in which hypothermia was an associated comorbidity as compared to normothermic babies and also the severity of hypothermia associated with it.
- b) Case fatality rate in the different disease manifestations mentioned above in which hypothermia was an associated comorbidity.

Statistical Methods: The data obtained was tabulated and analysed statistically using social science system version SPSS.16

IV. RESULTS AND OBSERVATION

Analysis of the data showed the following-

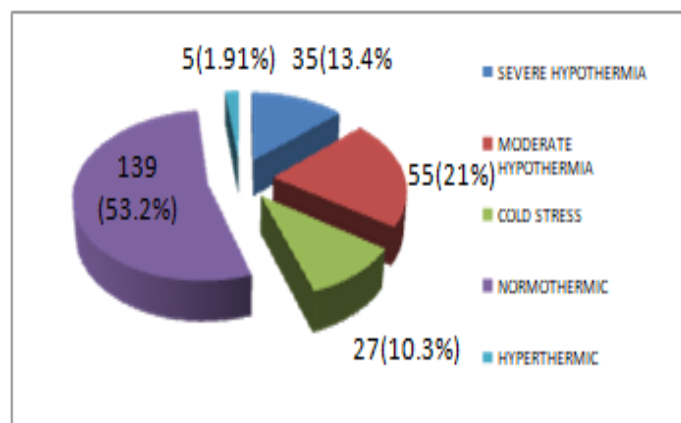


Figure1: Showing Grades Of Body Temperature At Admission

Total number of babies admitted during the period was 261 out of which 117(44.8%) babies presented with hypothermia and 35(13.4%),55(21.1%) and 27(10.3%) were severe hypothermia, moderate hypothermia and cold stress respectively. 139(53.2%) had normal temperature and 5(1.91%) had hyperthermia.

Table 1 :Comparison Of Maternal

VARIABLES	SUB GROUPS	<32°Cn(%)	32-35.9°Cn(%)	36-36.4°C n(%)	36.5-37.5°Cn(%)	>37.5°C n(%)	p- value
1) Parity	Primipara	19(11.9%)	30(18.8%)	22(13.8%)	85(53.4%)	3(1.8%)	0.152
	Multipara	16(15.6%)	25(24.5%)	5(4.9%)	55(53.9%)	1(0.9%)	
2)Maternal age	<20 years	6(20.6%)	7(24.1%)	5(17.2%)	11(37.9%)	0	0.335
	20- 25 yrs	25(15.6%)	30(18.7%)	17(10.6%)	85(53.1%)	3(1.8%)	
	26- 30yrs	3(4.6%)	15(23%)	5(7.6%)	41(63%)	1(1.5%)	
	31-35 yrs	1(14.2%)	3(42.8%)	0	3(42.8%)	0	

Demographic Profile With Grades Of Body Temperature

Analysis of the data showed that parity and maternal age had no significant correlation with hypothermia recorded at admission as p value is >0.05 . Total 261 babies were admitted in the study period out of which mothers of 159 were primipara and 102 were multipara of which 71(44.6%) and 46 (45%) babies had hypothermia respectively. Mothers of 29 babies were < 20 years, 160 babies were between 20- 25 years, 65 babies were between 26- 30 years and 7 babies were between 31 – 35 years of which 16 (55.1%), 72 (45%), 23 (35.3%) and 4 (57.1%) babies have hypothermia respectively

Table 2:Comparison Of Neonatal Factors With Grades Of Body Temperature

VARIABLES	SUB GROUPS	$<32^{\circ}\text{C}$ n(%)	32- 35.9°C n(%)	36- 36.4°C n(%)	36.5- 37.5°C n(%)	$>37.5^{\circ}\text{C}$ n(%)	P- VALUE
GESTATIONAL AGE	30 WKS	2(50%)	1(25%)	0	1(25%)	0	0.019
	32 WKS	5(45.4%)	4(36.3%)	1(9%)	1(9%)	0	
	34 WKS	1(3.8%)	9(34.6%)	4(15.3%)	12(46.1%)	0	
	36 WKS	6(14.2%)	9(21.4%)	8(19%)	19(45.2%)	0	
	38 WKS	19(11.3%)	29(17.2%)	14(8.3%)	102(60.7%)	4(2.3%)	
	40 WKS	2(20%)	3(30%)	0	5(50%)	0	
SEX	MALE	21(13.9%)	29(19.2%)	16(10.5%)	83(54.9%)	2(1.3%)	0.925
	FEMALE	14(12.7%)	26(23.6%)	11(10%)	57(51.8%)	2(1.8%)	
WEIGHT	$<1\text{KG}$	1(50%)	1(50%)	0	0	0	0.001
	1 - $<1.5\text{ KG}$	7(41.1%)	4(23.5%)	0	6(35.2%)	0	
	1.5- $<2.5\text{KG}$	15(16.1%)	23(24.7%)	15(16.1%)	39(41.9%)	1(1%)	
	$\geq 2.5\text{ KG}$	12(8%)	27(18.1%)	12(8%)	94(63%)	4(2.6%)	

Analysis of the data(Table 2) showed that gestational age($p=0.019$) and weight($p=0.001$) has significant correlation with hypothermia where as sex ($p=0.925$) has no significant correlation with outcome.

Of 261 babies admitted in the study period, 178 were term and 83 were preterm. Amongst 83 preterm, 50(60%)& amongst 178 term 67(37.6%) had hypothermia. Four were 30 weeks of gestation, 11 were 32 weeks of gestation, 26 were 36 weeks of gestation, 168 were 38 weeks of gestation and 10 were 40 weeks of gestation out of which 3(75%), 10(90.9%), 14(53.8%), 23(88.4%), 62(59.6%) and 5(50%) had hypothermia respectively. So preterm babies had more hypothermia than term babies. Amongst preterm babies 14(16.8%) had severe hypothermia, 23(27.7%) had moderate hypothermia and 13(15.6%) had cold stress. Amongst 30 weeks of gestation babies 2(50%), 1(25%) had severe and moderate hypothermia respectively. Amongst 32 weeks of gestation babies 5(45.4%), 4(36.3%) and 1(9%) had severe hypothermia, moderate hypothermia and cold stress respectively. Amongst the 34 weeks of gestation babies 1(3.8%), 9(34.6%) and 4(15.3%) babies had severe hypothermia, moderate hypothermia and cold stress

respectively. Amongst the 36 weeks of gestation babies 6(14.2%), 9(21.4%) and 8(19%) babies had severe hypothermia, moderate hypothermia and cold stress respectively. Thus we see that the severity of hypothermia was more in early preterm babies than in late preterm babies.

Males were 151 and 110 were females of which 66(43.7%) and 51(46.3%) had hypothermia respectively.

ELBW were 2 of which both(100%),VLBW were 17 of which 11(64.7%), LBW were 92 of which 53 (57.6%)and 149 were $\geq 2.5\text{ kg}$ of which 81(54%) had hypothermia respectively. Among the ELBW babies 1(50%) had severe and 1(50%) had moderate hypothermia. Among the VLBW babies 7(41.1%) had severe hypothermia and 4(23%) had moderate hypothermia. Among the LBW babies 15 (16.1%), 23(24.7%) and 15(16.1%) babies had severe hypothermia, moderate hypothermia and cold stress respectively. Thus, we see that highest prevalence of hypothermia was in ELBW babies followed by VLBW and then the LBW babies. The severity of hypothermia was also more in ELBW babies which is followed by VLBW and LBW babies.

Table 3:Comparison Of Season Of Admission With Grades Of Body Temperature

VARIABLES	SUB GROUPS	$<32^{\circ}\text{C}$ n(%)	32- 35.9°C n(%)	36- 36.4°C n(%)	36.5- 37.5°C n(%)	$>37.5^{\circ}\text{C}$ n(%)	P- VALUE
SEASON	DEC, JAN	18(17.4%)	21(20.3%)	7(6.7%)	54(52.4%)	3(2.9%)	0.042
	FEB,MAR	13(15.4%)	13(15.4%)	8(9.5%)	50(59.5%)	0	
	APR, MAY	4(5.5%)	21(29.1%)	12(16.6%)	3(47.2%)	1(1.3%)	

Analysis of the data (table 3)showed that season of admission had significant correlation with hypothermia as p value is < 0.05 . In winter season(Dec,Jan) 103 babies came, 84

babies came in normal climate (Feb, Mar),72 babies came in summer(April,May) of which 46(44.6%),34(40.4%) and 37(51.3%) had hypothermia respectively. Amongst the babies

that came in winter season 18(17.7%) had severe hypothermia, 21(20.3%) had moderate hypothermia and 7(6.7%) had cold stress. Amongst the babies that came in February and March 13(15.4%) had severe hypothermia, 13(15.4%) had moderate hypothermia and 8(9.5%) had cold stress. Amongst the babies that came in early part of summer season (April and May) 4(5.5%) had severe hypothermia, 21(29.1%) had moderate hypothermia and 12(16.6 %) had cold stress respectively. Thus, we see that though maximum number of hypothermic babies presented in summer season but severe hypothermia was more in winter season.

Total serum bilirubin(TSB), Random Blood sugar(RBS), birth asphyxia and shock had significant correlation with

hypothermia as p value is < 0.05 where as neonatal sepsis and respiratory distress did not have significant correlation with hypothermia as p value is > 0.05

Amongst the 102 babies having neonatal sepsis 50(49%) had hypothermia of which 21(20.5%), 25 (24.5%) and 4(3.9%) babies had severe hypothermia, moderate hypothermia and cold stress respectively.

Amongst the 43 babies having neonatal jaundice 16(37.2%) had hypothermia of which 1(2.3%), 4(9.3%) and 11(25.5%) babies had severe hypothermia, moderate hypothermia and cold stress respectively.

Table3:Comparison Of Different Disease Manifestation With Grades Of Body Temperature

VARIABLES	SUB GROUPS	<32°C n(%)	32- 35.9°Cn(%)	36- 36.4°Cn(%)	36.5- 37.5°Cn(%)	>37.5°Cn(%)	P- VALUE
NEONATAL SEPSIS	EONS WITHOUT MENINGITIS	12(22.6%)	14(26.4%)	3(5.6%)	24(45.2%)	0	0.59
	EONS WITH MENINGITIS	2(66.6%)	1(33.3%)	0	0	0	
	LONS WITHOUT MENINGITIS	6(14.6%)	8(19.5%)	1(2.4%)	25(60.9%)	1	
	LONS WITH MENINGITIS	1(20%)	2(40%)	0	2(40%)	0	
TSB	HYPERBILIRUBINEMIA	1(2.3%)	4(9.7%)	11(26.8%)	26(63.4%)	1(2.3%)	0.000
	NORMAL TSB	34(15.5%)	51(23.3%)	16(7.3%)	114(52.2%)	3(1.3%)	
BIRTH ASPHYXIA	WITH NO HIE	1(6.25%)	6(37.5%)	3(18.7%)	6(37.5%)	0	0.001
	WITH HIE II	2(5.4%)	10(27%)	2(5.4%)	23(62.1%)	0	
	WITH HIE III	4(66.6%)	2(33.3%)	0	0	0	
RESPIRATORY DISTRESS	CONG PNEUMONIA	1(8.3%)	2(16.6%)	1(8.3%)	7(58.3%)	1(8.3%)	0.12
	HMD	5(62.5%)	1(12.5%)	1(12.5%)	1(12.5%)	0	
	TTNB	0	0	0	2(100%)	0	
	ASPIRATION PNEUMONIA	0	0	0	2(100%)	0	
	MAS	0	2(66.6%)	1(33.3%)	0	0	
RBS	HYPOGLYCEMIA	16(57.1%)	8(28.5%)	1(3.5%)	3(10.7%)	0	0.000
	NORMOGLYCEMIA	17(8.1%)	39(18.6%)	23(11%)	126(60.2%)	4(1.9%)	
	HYPERGLYCEMIA	2(8.3%)	8(33.3%)	3(12.5%)	11(45.8%)	0	
SHOCK	CRT≥3 SEC	18(64.2%)	9(32.1%)	0	0	1(3.5%)	0.000
	CRT< 3 SEC	17(7.2%)	46(19.7%)	27(11.5%)	140(60%)	3(1.2%)	

Amongst the 59 babies who came with birth asphyxia 30(50.8%) had hypothermia of which 7(11.8%), 18(30.5%) and 5(8.4%) babies had severe hypothermia, moderate hypothermia and cold stress respectively. Thus maximum hypoxic babies had moderate hypothermia. Amongst the 6 babies with HIE III all(100%) had hypothermia of which 4(66.6%), 2(33.3%) babies had severe hypothermia, moderate hypothermia respectively. Thus HIE III babies presented with severe hypothermia.

Amongst the 8 babies who came with HMD 7(87.5%) had hypothermia of which 5(62.5%), 1(12.5%) and 1(12.5%) babies had severe hypothermia, moderate hypothermia and cold stress respectively. Thus maximum HMD babies presented with severe hypothermia.

Amongst the 28 hypoglycaemic babies 25(89.2%) had hypothermia of which 16(57.1%), 8(28.5%) and 1(3.5%) babies had severe hypothermia , moderate hypothermia and cold stress respectively. Amongst the 24 hyperglycaemic babies 13(54.1%) had hypothermia of which 2(8.3%), 8(33.3%) and 3(12.5%) babies had severe hypothermia, moderate hypothermia and cold stress respectively.

Amongst the 28 babies with shock 27(96.4%) had hypothermia of which 18(64.2%), 9(32.1%) babies had severe hypothermia , moderate hypothermia respectively. Thus, maximum babies in shock presented with severe hypothermia.

VARIABLES	SUB GROUPS	<32°C	32-35.9°C	36-36.4°C	36.5-37.5°C	>37.5°C	P- VALUE
OUTCOME	DISCHARGED	6(3.4%)	27(15.6%)	24(13.8%)	114(65.8%)	2(1.1%)	0.000
	DAMA	3(8.8%)	7(20.5%)	2(5.8%)	21(61.7%)	1(2.9%)	
	EXPIRED	26(48.1%)	21(38.8%)	1(1.8%)	5(9.2%)	1(1.8%)	

Table 4: Comparison Of Outcome With Grades Of Body Temperature

Analysis of the data showed that outcome had significant correlation with hypothermia as p value is < 0.05. Amongst the 54 babies expired 48(96.4%) had hypothermia

of which 26(48.1%), 21 (38.8%) and 1(1.8%) babies had severe hypothermia, moderate hypothermia and cold stress respectively

Table 5: Comparison Of Babies Expired Due To Different Diseases With Grades Of Body Temperature

VARIABLES	SUB GROUPS	<32°C	32-35.9°C	36-36.4°C	36.5-37.5°C	>37.5°C	PERCENTAGE OF EXPIRED BABIES WITH HYPOTHERMIA	TOTAL BABIES ADMITTED WITH THE DISEASE	CASE FATALITY RATE OF HYPOTHERMIC BABIES
NEONATAL SEPSIS	EONS WITHOUT MENINGITIS	11	6	0	2	0	29/31=93.5%	50	29/50=58%
	EONS WITH MENINGITIS	1	0	0	0	0			
	LONS WITHOUT MENINGITIS	3	5	0	0	0			
	LONS WITH MENINGITIS	1	2	0	0	0			
TSB	HYPERBILIRUBINEMIA	1	0	0	0	0	100%	16	1/16=6.25%
BIRTH ASPHYXIA	WITH NO HIE	0	0	0	0	0	100%	30	7/30=23.3%
	WITH HIE II	0	2	0	0	0			
	WITH HIE III	3	2	0	0	0			
RESPIRATORY DISTRESS	CONG PNEUMONIA	1	1	0	0	0	10/11=90.9%	14	10/14=71.4%
	HMD	5	1	1	0	0			
	TTNB	0	0	0	0	0			
	ASPIRATION PNEUMONIA	0	0	0	1	0			
	MAS	0	1	0	0	0			
RBS	HYPOGLYCEMIA	12	3	0	1	0	15/16=93.7%	25	15/25=60%
SHOCK	CRT≥3 SEC	17	9	0	0	1	96.2%	27	26/27=96.2%

Mortality due to various causes in which hypothermia was an associated comorbidity was neonatal sepsis(93.5%), kernicterus(100%), birth asphyxia(100%), respiratory distress(90.9%), hypoglycaemia(93.7%), and shock(96.2%). Case fatality rate among hypothermic babies (total number of expired babies having hypothermia with the underlying disease/ total number of hypothermic babies with the underlying disease) having neonatal sepsis is 58%, kernicterus is 6.25%, birth asphyxia is 23.3%, respiratory distress is 71.4%, hypoglycaemia is 60%, and shock is 96.2%.

V. DISCUSSION

In our study 44.8% babies presented with hypothermia on admission which is significantly a large proportion, of which 13.4%, 21.1% and 27% babies had severe hypothermia, moderate hypothermia and cold stress respectively. In Ethiopia(4), Zambia(5) and Zimbabwe(6), one-half to two-third of babies evaluated were hypothermic. Parity, maternal age, sex of the baby did not have any significant correlation with hypothermia. Similar results were also found in the study of Delavar MA, Akbarianrad Z, Mansouri MM et al(7). Preterm babies had more hypothermia than the term babies and the severity of hypothermia was also increased in more preterm

babies than the late preterm babies. ELBW babies had more severe hypothermia which is followed by VLBW and then LBW babies as compared to normal birth weight babies. In a community based study conducted at Shivgarh(8,9), rural India prevalence of hypothermia was more in both LBW(49%) and normal birth weight babies(43%), whereas in study of Delavar et al(4) prevalence of hypothermia was more in LBW and preterm babies. In our study, maximum number of hypothermic babies presented in summer season(51.3%) but severe hypothermia was more in winter season. In the study by Kumar V, Shearer JC, Kumar A et al(10) 70% babies presented in winter season. The study by Bang AT, Reddy HM, Deshmukh MD et al(11) showed that more babies presented in winter than summer season. In our study maximum hypothermia reported in summer season can be because of lack of awareness among people about proper clothing required in summer season to prevent hypothermia. Among the babies expired hypothermia was an associated comorbidity in 96.4% of which 48.1%, 38.8% and 1.8% babies had severe hypothermia, moderate hypothermia and cold stress respectively. Thus we see that hypothermia and also the severity of hypothermia was a significant comorbidity associated with death. Mortality due to neonatal sepsis, kernicterus, birth asphyxia, respiratory distress,

hypoglycaemia, and shock in which hypothermia was an associated comorbidity was 93.5%, 100%, 100%, 90.9%, 93.7% and 96.2% respectively. Case fatality rate among hypothermic babies having neonatal sepsis is 58%, kernicterus is 6.25%, birth asphyxia is 23.3%, respiratory distress is 71.4%, hypoglycaemia is 60%, and shock is 96.2%. Thus we see that hypothermia was a significant comorbidity associated with mortality due to various causes.

VI. CONCLUSION

Neonatal hypothermia is a condition of major public health importance in India. Nearly 50% of neonates presented with hypothermia in the tertiary care hospital despite ongoing training in neonatal care. Transport of neonates is a significant source of cold exposure. Awareness about the disease is still low amongst caregivers and health workers. As hypothermia is a significant comorbidity associated with mortality, prevention of hypothermia will reduce mortality significantly. Therefore continuous effort at sensitising caregivers on the thermal needs of newborn should be given due importance.

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