

PREVALENCE OF HYPOTHERMIA AMONG NORMAL TERM NEONATES IN A SOUTH INDIAN CITY AND ASSESSMENT OF PRACTICE AND KNOWLEDGE RISK FACTORS AMONG MOTHERS – A HOSPITAL BASED CROSS-SECTIONAL STUDY

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Abstract

Body temperature of a new born below 36.5°C in axilla is neonatal hypothermia. Hypothermia has serious health concerns in a developing child and may lead to short stature, delayed growth and even death. A cross sectional study was done at a secondary care hospital in Erode city to estimate the prevalence of neonatal hypothermia among normal term neonates and to determine practice and knowledge risk factors among postnatal mothers. Consecutive sample of all healthy term new born infants born during the winter months of December 2014-January 2015 were measured consecutively, of 2 temperatures, once in the morning and evening. Total number of mothers and babies studied were 204. The prevalence of hypothermia was 44.1% [95% Confidence Interval (CI) 37.29-50.91%]. Number of hypothermic episodes were 134 (out of 204; 32.84%). Babies that were by the mothers' side, [Adjusted Odds Ratio (AOR) 3.579, 95% CI 1.162 - 11.026], head covered (AOR 15.769, 95% CI 1.602 – 155.257) and breast fed within one hour of birth (AOR 3.324, 95% CI 1.219 – 9.067) were significantly protected from hypothermia. The knowledge regarding neonatal thermo-regulation was poor with misconceptions like babies shiver ($p = 0.014$; AOR 4.599, 95% CI 1.308 – 16.172). Thus, prevalence of neonatal hypothermia was considerably high despite good neonatal warm chain practices observed. The knowledge on neonatal thermoregulation among the mothers was poor and hence regular health education is warranted.

Keywords:

*Hypothermia, Neonate,
Newborn, Prevalence,
Temperature*

Introduction

Neonatal Hypothermia is defined as any one axillary temperature recorded to be less than 36.5 degree Celsius [1]. According to the World Health Organization (WHO), Hypothermia in neonates can be classified as mild or cold stress (36.4 – 36.0C), moderate (32.0 – 35.9C) and severe (< 32C) [1]. In utero, the heat production of fetus leads to an environment which is approximately half a degree higher than the mother's body temperature and thus during birth, the baby is exposed to a totally new environment with higher risk of heat loss [2]. After birth, deep body and skin temperature of the term newborn can drop at a rate of approximately 0.1°C and 0.3 °C per minute respectively unless immediate action is taken [3]. The naked newborn exposed to a temperature of 23°C suffers the same heat loss as an adult in 0°C [1]. It is therefore necessary to maintain an optimal thermal environment especially in a sick or low birth weight new born. Wiping the child dry, keeping the child covered with appropriate clothes, placing the child on a warm surface in a warm room, early & adequate breast feeding and postponing bathing are some essential components of the "Warm chain" [4]. Hospital based studies in south Asia and sub Saharan Africa have demonstrated a high incidence of primary hypothermia, especially in the early days of life [5]. It is a significant contributory factor in neonatal mortality and morbidity in both developed and developing countries [6,7] as it may cause hypoglycaemia [8], respiratory distress [9], hypoxia & metabolic acidosis [10], coagulation defects [11], delayed readjustment from fetal to newborn circulation [12], acute renal failure, necrotizing enterocolitis, failure to

increase in weight or weight loss [13]. The data on prevalence of neonatal hypothermia among normal term neonates is limited in India [14] and is scarce especially in south India. Therefore this study was aimed to measure the prevalence of hypothermia in normal term neonates during their hospital stay in a small city of Tamil Nadu and to determine practices and knowledge risk factors among postnatal mothers on neonatal thermoregulation.

Materials and methods

This was a cross sectional study conducted in a secondary care setting in Erode that specially caters to Maternity and child care and was ethically approved by the hospital committee. The study was conducted during the months of December 2014 and January 2015 which are the usual colder months of the year in Erode and the risk of children going into hypothermia is comparatively more. The daily media had reported temperature, maximum of 26°C – 32°C and minimum of 17°C – 23°C during the study period [16]. All apparently healthy term newborns with birth weight more than 2.5kg and age less than 48 hours of life born during the 2 months of study period, admitted in post-natal ward, along with their mothers, who gave a written consent were included in the study. Infants who were admitted in nursery and infants whose mothers were very sick were excluded. The sample size was 196, calculated with expected 45% prevalence of neonatal hypothermia based on a previous study done in Uttar Pradesh, India [14] and with a relative precision of 7.5%, α error of 5% and 10% non-responders. Temperature of a newborn was measured twice, once in the morning (between 07:00am and 08:00am) and once in the evening (between 07:00pm and 08:00pm) during the hospital visiting hours as we expect more incidences of improper warm chain practices due to baby handling by visitors during those times. Temperature was measured as suggested by the WHO, in the axilla using digital thermometer [1]. Knowledge of mothers regarding neonatal hypothermia was assessed by a semi structured pilot tested questionnaire and warm chain practices were directly observed by the investigators at the time of interview. Mothers were given a comprehensive health education after interview and if the baby was found to be hypothermic the immediate care-givers were informed and re-establishment of warm chain was ensured. Data entry was done using Epi Info™, version 7 (CDC, USA, 2011) and analysis was done using Statistical Package for Social Sciences (SPSS) for windows, version 20 (IBM Corp, USA, 2011)

Results

Baseline demographic data

Total number of mothers and babies studied were 204. The mean age of the mothers was 24.03% (SD 3.46) ranging from 18 years to 37 years and 81.4% of them were educated up to high school or above (Table 1). On the other hand, 49.0% of the babies studied were male and 58.8% of the babies studied were first live born to their parents. The mean birth weight was 3.03kg (Range: 2.50-3.98kg, SD: 0.37kg). The mean age at first temperature was 8hr 27min and the mean age at second temperature was 19hr 42min.

Prevalence of hypothermia

The prevalence of hypothermia in the study population was 44.1%. (95% Confidence Interval (CI), 37.29-50.91%). Cold stress was seen in 29.4% (95% CI 23.15 – 35.65%) while moderate hypothermia was noticed in 14.7% (95% CI 9.84- 19.56%) of all babies evaluated. There were no babies in severe hypothermia. Total number of temperatures measured were 408 (102 morning and 102 evening temperatures) and the number of hypothermic episodes were 134 (32.84%) of which 68 was in the morning

Practices observed

Table 2 depicts the univariate analysis results of various thermo-protective measures adopted by the mothers to keep their babies warm. Babies that were by the mothers' side, head and extremities covered and breast fed within one hour of birth were significantly protected from hypothermia. After adjusting for other known risk factors by logistic regression, except for extremities covered, the remaining three practices continued to be statistically significant. (Table 4)

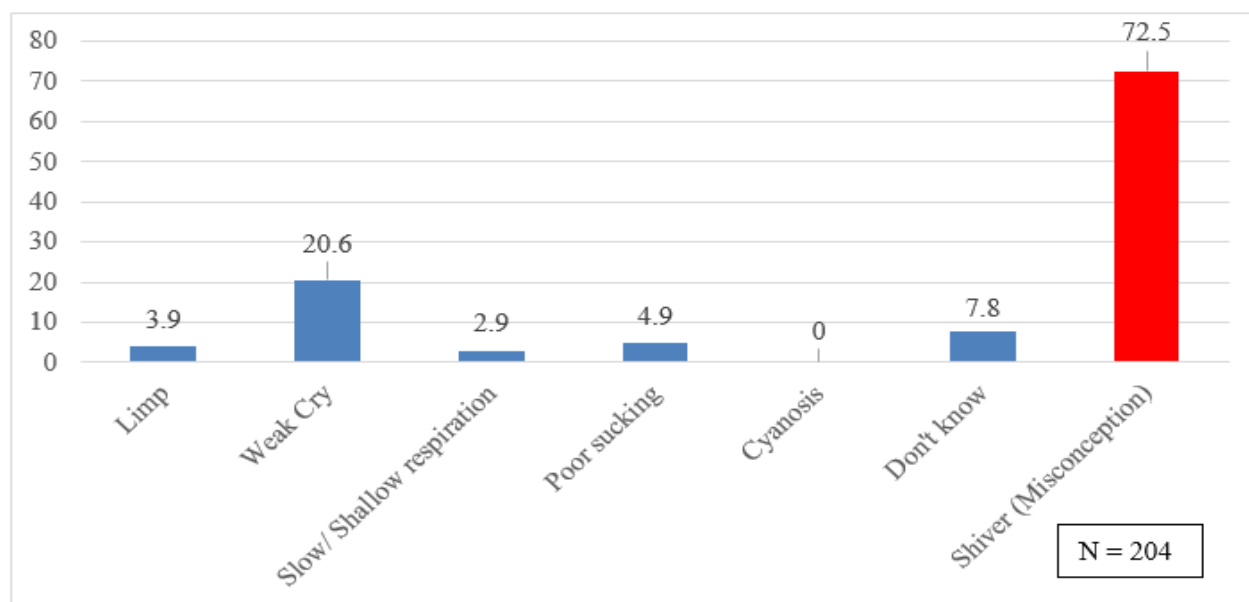
Assessment of knowledge:

Among all the mothers who were assessed for knowledge regarding neonatal thermal regulation only 35.3% of the mothers knew that neonates lose heat faster than adults and only 87.3% of them felt it is important to keep the baby

warm. 43.2% of mothers did not know that hypothermia can lead to life threatening complications and only 45.1% of mothers were aware that persistent hypothermia can affect the growth of the baby in the long run.

The mothers were asked an open question as to what could be the possible symptoms of hypothermia besides low body temperature and their responses are mentioned in Figure 1. The expected correct answers like limp ($p=0.777$), weak cry ($p=0.805$), slow/shallow respiration ($p = 0.404$) and poor sucking (0.068) were not statistically significant. On the other hand, 72.5% of mothers mentioned shivering as a symptom which correlated with their neonates being hypothermic ($p = 0.007$; OR 3.87, 95% CI 1.408 – 10.64). Table 3 depicts the percentage of various responses given by the mothers as different methods to keep the babies warm. Univariate analysis revealed that babies whose mothers knew covering head ($p = 0.009$) and keeping the baby by the mother's side ($p = 0.000$) as measures of preventing hypothermia were protected from hypothermia. These factors continued to remain significant after binary logistic analysis (Table 4)

Figure:



Proportion of mothers who gave correct response regarding various symptomatology

Tables:

Table 1. Demographic characters of the Mothers (N=204)

Demography	Classification	Frequency (%)
Age (years)	21 years and below	50 (24.5)
	Between 21 & 30 years	138 (67.7)
	30 years and above	16 (7.8)
Education	Illiterate	7 (3.4)
	Primary school	3 (1.5)
	Middle school	28 (13.7)
	High school	69 (33.8)
	Post-school diploma	71 (34.8)
	Graduate	23 (11.3)
	Profession	3 (1.5)
Occupation	Unemployed	4 (2.0)
	Unskilled	72 (35.3)
	Semi-skilled	36 (17.6)

Family SES (Modified Kuppuswamy class) [24]	Skilled	34 (16.7)
	Clerk, farmer, shop owner	15 (7.3)
	Semi-profession	3 (1.5)
	Profession	40 (19.6)
	Upper	17 (8.3)
	Upper middle	29 (14.2)
	Lower middle	50 (24.5)
	Upper lower	106 (52.0)
Lower	2 (1.0)	

Table 2. Correct practices observed (N=204)

Practices observed	Hypothermic Baby (%)	Normothermic Baby (%)	Total (% of N)	Univariate analysis	
				OR (95% CI)	p value
Baby by Mothers side					
No	46 (52.3)	16 (13.8)	62 (30.4)	6.845 (2.641 – 17.741)	.000
Yes	42 (47.7)	100 (86.2)	142 (69.6)		
Extremities covered					
No	22 (25.0)	7 (6.0)	29 (14.2)	4.500 (1.324 – 15.297)	.011
Yes	66 (75.0)	109 (94.0)	175 (85.8)		
Head covered					
No	27 (30.7)	2 (1.7)	29 (14.2)	23.903 (2.985 – 191.419)	.000
Yes	61 (69.3)	114 (98.3)	175 (85.8)		
Baby clothed					
No	20 (22.7)	16 (13.8)	36 (17.6)	1.838 (0.658 – 5.132)	.298
Yes	68 (77.3)	100 (86.2)	168 (82.4)		
Early breast feeding					
No	52 (59.1)	35 (30.2)	87 (42.6)	3.210 (1.415 – 7.280)	.005
Yes	36 (40.9)	81 (69.8)	117 (57.4)		
Bathing after 1st day					
No	6 (6.8)	1 (0.9)	7 (3.4)	4.171 (0.419 – 41.537)	.189
Yes	82 (93.2)	115 (99.1)	197 (96.6)		

Table 3. Assessment of knowledge regarding methods to keep the baby warm (N=204)

Mothers' response	Hypothermic Baby (%)	Normothermic Baby (%)	Total (% of N)	Univariate analysis	
				OR (95% CI)	p value
Clothing the baby					
No	2 (2.3)	1 (0.9)	3 (1.5)	1.326 (.081 – 21.797)	0.843
Yes	86 (97.7)	115 (99.1)	201 (98.5)		
Bathing after first day					
No	87 (98.9)	115 (99.1)	202 (99.0)	0.754 (0.046 – 12.405)	0.843
Yes	1 (1.1)	1 (0.9)	2 (1.0)		
Adequate breast feeding					
No	72 (81.8)	108 (93.1)	180 (88.2)	0.333 (.093 – 1.190)	0.080

Yes	16 (18.2)	8 (6.9)	24 (11.8)		
Early breast feeding					
No	87 (98.9)	116 (100)	203 (99.5)	0.426 (0.339 – 0.534)	0.249
Yes	1 (1.1)	0 (0)	1 (0.5)		
Covering extremities					
No	54 (61.4)	77 (66.4)	131 (64.2)	0.836 (0.371 – 1.885)	0.683
Yes	34 (38.6)	39 (33.6)	63 (35.8)		
Covering head					
No	75 (85.2)	46 (39.7)	121 (59.3)	9.638 (3.514 – 26.435)	0.009
Yes	13 (14.8)	70 (60.3)	83 (40.7)		
Keeping the baby by the mother's side					
No	60 (68.2)	20 (17.2)	80 (39.2)	10.286 (4.055 – 26.093)	0.000
Yes	28 (31.8)	96 (82.8)	124 (60.8)		

Table 4. Multivariate analysis using binary logistic regression.

Variable	Adjusted Odds Ratio (95% CI)	p value
Practices Observed		
Baby by mother's side*	3.579 (1.162 – 11.026)	.026
Extremities Covered*	3.967 (.886 – 17.771)	.072
Head covered*	15.769 (1.602 – 155.257)	.018
Early Breast Feeding*	3.324 (1.219 – 9.067)	.019
Knowledge Risk Factors		
Shivering #	4.599 (1.308 – 16.172)	.017
Covering head #	4.347 (1.350 – 14.003)	.014
Keeping the baby by mother's side #	7.540 (2.377 – 23.921)	.001
*Adjusted with known risk factors for neonatal hypothermia (birth weight & gestational age) # Adjusted with known risk factors for hypothermia (birth weight & gestational age) and poor knowledge among mothers on neonatal thermoregulation (parity of mother & mother's education)		

Discussion

Prevalence of neonatal hypothermia in our study is as high as 44% which is comparable with similar such studies done in India [15] despite good practices observed. These babies are at an increased mortality risk over the first 28 days of life [5] and morbidity risk even up to 2 months of age [17]. Babies whose heads were covered were protected from hypothermia by nearly 16 times when compared to those whose heads were left uncovered and the risk was almost 3 times less if they were breast fed within 1st hour of life or if they were kept by the side of the mother (Table 4). A baby can lose heat by conduction, convection, radiation or evaporation, the most important factor being loss of heat due to evaporation of amniotic fluid from the body surface [1]. If adequate precautionary measures are not taken during the first few minutes of life, the neonate can lose skin temperatures of up to 4°C rapidly [10]. Therefore mothers should take extra precautions during the colder days.

Acute manifestations of hypothermia are peripheral vasoconstriction (acrocyanosis & cool extremities) and central nervous system depression (lethargy, bradycardia, apnea & poor feeding) [1]. Chronic hypothermia manifests as weight loss or poor weight gain [1]. Except for slow and shallow respiration, the other symptoms like limp, weak cry and poor sucking were not statistically significant probably because of poor responses and a small sample size. None of them were aware of peripheral cyanosis and 7.8% of mothers could not mention even one symptom of neonatal hypothermia. Neonates do not exhibit most of the heat loss prevention mechanism as in adults but generate heat by non-shivering thermogenesis due to activation of the adrenergic system [2]. However almost three-fourths of the mothers mentioned shivering to be a symptom of hypothermia and this explains a possible callous attitude of the mothers towards prophylactic warm chain practices as they expect their babies to shiver as the body temperature

drops. These babies were almost 4.5 times at a higher risk for developing hypothermia (Table 4)

Few mothers were aware about the importance of keeping the neonate by their side, and covering the head as effective measures of maintaining temperature which has also been proved as significant knowledge factors in preventing hypothermia in our study. Whereas, the study has brought out the poor knowledge among mothers about avoiding bath on the first day and the role of early and adequate breast feeding in maintaining the body temperature of the neonate. It has also brought out contrasting differences between the good practices being observed and poor knowledge. This points out that the mothers are mechanically following what has been taught to them by the family or the health care team without understanding the reasons behind each practice they follow. Therefore for a strict and long term adherence to these good practices, it is extremely important to bridge the gap between knowledge and practice [18, 19].

Despite various studies pointing out the importance of establishing early breast feeding, babies are still not fed early enough as prescribed by the WHO [20]. Only 57.4% of all mothers initiated breast feeding within the prescribed time. This is comparable to other published Indian studies which show that initiation rates vary from 16 to 54.5% [21]. The health care team especially the labor ward staff should be urged to visualize the first breast feed before the mother is shifted to the post-natal ward. Some studies have pointed out that one of the most important causes of delay in initiating breast feeding is because of family restrictions [22]. Thus educating the family members regarding the initiation of breast feeding is also equally important and they in turn motivate mothers to initiate early breast feeding.

One of the important shortfall of the study is that only 2 temperatures were measured in babies through their entire stay in hospital. Therefore there is a likelihood of having missed out more hypothermic babies during the interim period. Lack of standardization of observation of practices is yet another limitation. For example, the study was not powered to look at the material, thickness and number of layers of clothing with which the babies were covered. This could be one of the reasons for a high prevalence of hypothermia despite good practices being observed and therefore it is worth exploring and educating the mothers on the type of cloth material to be used and advise them to use thicker clothes during winter. Alternatively they may be taught to clothe their babies in 2 or 3 layers of clothes so that the intervening air between each layer of cloth acts as an insulator [23].

Conclusion

The prevalence of neonatal hypothermia as per our study was 44.1% (95% CI 34.46-53.74%) and the practices observed seemed adequate (min 56.9% - max 96.1%) despite a fairly high prevalence rate of hypothermia. This is probably due to lack of complete standardization of observation of practices. Even term neonates with normal birth weight should be monitored regularly of their temperature during their first few days of life and mothers accordingly trained to take appropriate corrective measures by picking up symptoms of hypothermia. Mothers have to be educated on the thickness and material used for clothing neonates or advised to use multi-layered clothing. The knowledge of the symptoms of hypothermia was very poor with certain gross misunderstandings like babies shiver (72.5%). Therefore health education, along with the explanation for each instruction given, must be taught to all mothers including the members of the household such that their adherence rates to such advices always remain high in the community

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