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ORIGINAL ARTICLES

Neonatal hypothermia on admission to a special care unit in Dar-es-Salaam, Tanzania: a cause for concern

KP MANJI, R KISENGE

Abstract

Objective: To determine the prevalence and risk factors for hypothermia among neonates on admission to the Neonatal Care Unit.

Hypothermia in newborn babies is a problem in tropical countries despite warm environmental conditions and it contributes to a high neonatal morbidity and mortality.

Methodology: A study was undertaken to determine the prevalence of hypothermia and its association with early neonatal outcome among neonates admitted to the Neonatal Care Unit of Muhimbili Medical Centre . At admission all neonates were examined and axillary temperature recorded using a low-reading thermometer. Six-hourly temperature was taken in all infants. Those with a temperature below 36.5°C were recruited as cases and those with normal temperature served as controls. These neonates were followed up for early neonatal outcome.

Results: Hypothermia on admission was found in 366 out of 1 632 babies (22.4%). In none of these was hypothermia recorded or reported as a reason for admission. Thirteen percent of the hypothermic neonates had severe hypothermia, with body temperature below 32°C on admission. Hypothermia was significantly associated with deliveries from outside hospitals and with those who had operative or instrumental delivery in the same hospital. It was also associated with prematurity, low birth weight babies, time taken to transfer the baby and inadequate clothing after delivery. It was found that hypothermic infants had a three fold higher mortality and morbidity. These infants had a longer stay in the unit and had a higher post natal weight loss. There was no low-reading thermometer in the unit.

Conclusion: It is concluded that there is cause for concern about hypothermia in the neonates at Muhimbili Medical Centre. Efforts should be made to sensitize and educate all levels of staff dealing with neonates, and low-reading thermometers should be part of the essential kit in the unit.

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Introduction

Neonatal hypothermia carries a significant morbidity and mortality. It is common even in the tropical countries despite a warm environment. It is known that even a single episode of hypothermia at birth may increase morbidity and mortality.[1] There is little emphasis given to hypothermia in neonates and there is no reliable information on this easily preventable problem in Tanzania. This study was therefore conducted with the main objective of determining

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the prevalence of admission hypothermia and its associated factors and to sensitize the staff about this easily preventable condition.

Materials and Methods

A cross sectional study was conducted in the Neonatal Care Unit of Muhimbili Medical Centre (MMC), Dar-es-Salaam, Tanzania to determine the prevalence of hypothermia among neonates on admission. MMC is a tertiary referral centre and teaching hospital. The unit has a capacity of 70 beds. The total annual admissions range between 5 000 to 6 000 neonates. Neonates are admitted from outside the hospital and those delivered within the hospital. Deliveries are almost always conducted by the attending midwife, except for operative deliveries, which are conducted by doctors. The neonatal unit has four rooms; each one has double glazed glass windows and electric heaters. The temperature of the warmest room for premature babies is 30 to 31°C and the humidity is 80%. During the period of this study, the temperature in Dar-es-Salaam ranged from 23 to 30°C and the humidity was 60% (Tanzania Meteorological Department).

The study population comprised all newborn infants admitted to the neonatal unit during the study period of four months, from July to October 1996. These neonates were followed up for four weeks. Temperature on admission was taken by the author or a designated nurse for this purpose during every shift. A case control study was conducted to identify possible risk factors for hypothermia.

All neonates with an axillary temperature of less than 36.5°C on admission were recruited as cases, and the subsequent neonate with a temperature of 36.5 to 37.5°C was recruited as a control.

Newborn infants with an axillary temperature of >37.5°C on admission were excluded from the study.

At recruitment maternal, *antenatal, intrapartum* and *postpartum* details were recorded. These were obtained from the history, admission records, partograms, referral letters and the nurse accompanying the baby. This was followed by the routine physical examination, observation of the baby including the clothing and gestational age assessment by Dubowitz.[2]

The measurement of axillary temperature was done with a low-reading mercury thermometer (Premier BS 691 YX S-Norm-NHS) with a scale between 25 to 40°C. The thermometer was shaken down to 25°C and placed in the right or left axilla. The bulb of the thermometer was placed at the apex and half way between the anterior and posterior margins of axilla. The arm was then held firmly but gently for five minutes to allow the temperature to stabilize. Thereafter, the temperature was recorded every six hours while in the unit. The thermometer was cleansed with cotton wool soaked in methylated ehthyl alcohol. The weight was recorded daily using a standard scale (Seca) to the nearest 10 grams.

Newborn babies found to be sick or hypothermic were managed according to the management protocols of the unit. Normal neonates who developed hypothermia while in the ward were excluded from the study and were replaced by other normal normothermic neonates.

Exit point from the study was when the infant was discharged or died. On discharge, the diagnosis, date of discharge and treatment given was all recorded. In case of death, the causes of death were classified according to the World Health Organization Manual of International Statistics Classification of disease.[3]

Operational definitions.

Adequate clothing: two or more items of clothing covering the whole body including the head.

Cold stress: 36 to36.5°C.

Moderate hypothermia:32 to 35.9°C.

Severe hypothermia:<32°C.

Statistical analysis was done using the SPSS programme. Significance testing was done using the Chi-squared test, student's T test or Kruskal-Wallis test as appropriate. Multiple logistic regression analysis was done to identify independent risk factors for hypothermia. The statistic was considered significant if the p value was less than 0.05.

Permission to carry out this survey was granted by the Ethical Committee of the Research and Publications Committee, Muhimbili University College of Health Sciences. There were no ethical issues involved, as those with hypothermia were treated.

Results

A total of 1 632 newborn babies were admitted to the neonatal unit during the study period. Of these, 747 neonates were recruited into the study, 366 of whom had hypothermia on admission. The prevalence of hypothermia on admission was therefore 22.4% (366/1 632).

Of the 381 neonates recruited as controls, 15 (3.9%) developed hypothermia while in the neonatal ward, and were excluded from the present analysis.

None of the 366 neonates with hypothermia had any indication of hypothermia as a reason for admission, despite 13.1% of them having severe hypothermia at the time of admission. Forty eight out of 366 (13.1%) had severe hypothermia, 113 out of 366 (30.9%) had moderate hypothermia and 205 (56%) had cold stress.

Table I compares the body temperature at the time of admission and the mode of delivery and the place of delivery and birth attendant.

It is evident that most deliveries were from MMC. The analysis showed that hypothermia was significantly associated with delivery in a hospital by Caesarian section. Surprisingly, there was no significant association with home delivery. The temperature in the operating room was around 20 to 22°C, while ambient temperature ranged from 24 to 29°C.

Table I: The relationship of hypothermia to mode of delivery, place of delivery and birth attendant.

	Hypothermic (%) n=	Normothermic (%) n=	p value
Mode of Delivery			
SVD	190 (42.8)	254 (57.2)	
LSCS	147 (60.7)	95 (39.3)	0.000
ABD	14 (56)	11 (44)	0.195
LCVE	15 (71.4)	6 (28)	0.01
Place of Delivery			
MMC labour ward	150 (37.5)	250 62.5)	
MMC obstetric Theatre	147 (61)	94 (39)	0.000
Other hospitals	59 (79.7)	15 (20.3)	0.000
Home	10 (58.8)	7 (41.2)	0.08
Birth Attendant			
Nurse	204 (44)	260 (56)	
Doctor	161 (60.7)	104 (39.3)	0.000

SVD = ***spontaneous vertex delivery.***
ABD = ***assisted breach delivery.***
LSCS = ***low segment Caesarian section.***
LCVE = ***low cavity vacuum extraction.***
x^2 = ***Chi-squared.***
MMC = ***Muhimbili Medical Centre.***

The sex, birth weight and gestational age, time taken to transfer, breast feeding status and clothing is described in Table II. The Chi-squared test was used for comparison of percentages while the student's t-test compared means.

There was no significant difference between the hypothermic and normothermic infants in terms of breast feeding status. Very few of them were breastfed at the time of admission; 1.9% among the hypothermic and 2.7% among the normothermic infants.

Table II: Factors related to hypothermia.

	Hypothermia (%) n=366	Normothermic (%) n=366	p value
Sex			
Male	211 (51.3)	200 (54.6)	
Female	155 (48.3)	166 (45.4)	0.48
Birth Weight			
<2 500 grms	122 (59.2)	84 (23)	
≥2 500 grms	244 (46.4)	282 (77)	0.002*
Gestational Age			
<36 weeks	94 (61.8)	58 (15.8)	
≥36 weeks	272 (46.9)	308 (84.2)	0.001*
Breast Fed			
Yes	7 (1.9)	10 (2.7)	
No	359 (98.1)	356 (97.3)	0.462
Transfer Time			
In minutes (Mean ±SD)	88.14±72.05	52.55±37.82	0.000*
Clothing			
Adequate	245 (67)	347 (94.8)	
Inadequate	121 (33)	19 (5.2)	0.000*

t = student's t-test.
****Significant.***

Table III: Multiple logistic regression analysis for risk factors for hypothermia.

Variable	ß1	SE2	DF3	p value
Intrapartum Medications	0.3994	0.1732	1	0.021
Delivery by Caesarian section	1.3601	0.5049	1	0.007
Delivery by Low Cavity Vacuum	1.1556	0.3059	1	0.000
Delivery Obstetric Theatre	2.0394	0.3229	1	0.000
Delivery by Doctor	1.5185	0.2186	1	0.000
Birth Weight	-0.685	0.007	1	0.000
Clothing	-1.9316	0.3059	1	0.000

1ß = correlation coefficient
2SE = standard error of ß
3DF = degree of freedom

Table IV shows the various causes of morbidity among the hypothermic infants. Low birth weight, presence of respiratory distress syndrome (RDS), prematurity, birth asphyxia, haemorrhage and pneumonia were significantly higher among hypothermic infants.

Table IV : Morbidity pattern among hypothermic and normothermic infants.

Disease	Hypothermic (%) n=	Normothermic (%) n=	p value
Low birth weight	108 (59)	75 (41)	0.000*
Birth asphyxia	104 (60.8)	67 (39.2)	0.000*
Prematurity	82 (46.1)	48 (53.9)	0.000*
Infected liquor	41 (46.1)	48 (53.9)	0.294
RDS	44 (86.3)	7 (13.7)	0.000*
Cord sepsis	28 (53.8)	24 (46.2)	0.62
Septicemia	20 (66.7)	10 (33.3)	0.009*
Haemorrhage	18 (66.7)	9 (33.3)	0.14

RDS = respiratory distress syndrome.
****Significant.***

The mortality was higher among the hypothermic infants. Thirty three out of 366 hypothermic infants died, while 10 out of 381 normothermic infants died. The relative risk being 3.3.

The causes of death among the 43 neonates who died were birth asphyxia, septicaemia, pneumonia and RDS. These causes, although not different from the normothermic infants, were two to three times higher.

Discussion

The high prevalence of hypothermia on admission raises concern. Dar-es-Salaam had a temperature of 23 to 30°C during the study period. This confirms that hypothermia is a serious problem in neonates even in the tropics.

Hypothermia is a neglected issue among neonates in Dar-es-Salaam. Despite 13.1% having severe hypothermia on admission as recorded by the author, none had a record of temperature by other attending staff. This hypothermia could have occurred during transit time from labour ward, district hopsital or even from the theatre. Similar observations were reported in a study from Zambia.[4] Very little importance is given to maintaining body temperature,

maybe because of the notion that the environment is warm and a slight fall in temperature is often neglected. The other cause could be the availability of low-reading thermometers. The routine thermometers have the lowest temperature at 35°C.

As seen in Tables I, II and III neonates delivered in the hospital with a doctor were found to have significantly higher rates of hypothermia. This could be due to various reasons. Firstly, a doctor would only deliver these neonates if they fall in the "high risk" group such as obstructed labour. This in itself may be a predisposing factor for hypothermia. Secondly, most of the infants delivered by a doctor were delivered by Caesarian section, and this exposes the infant to the cool operation room environment and also poor attendance by the overworked nurses who are busy attending the mothers during such deliveries. Thirdly, the drugs given during the *intrapartum* period especially diazepam may predispose neonates to hypothermia.[1-5] All these causes of hypothermia are preventable.

Likewise, those infants who had instrumental delivery, in this set up Low Cavity Vacuum Extraction (LCVE), had a high incidence of hypothermia. There were 21 babies delivered by LCVE, seven of whom had scalp bruising and three had subaponeurotic bleeding. Bruising and bleeding are known to increase the risk of hypothermia.[6,7]

Obviously, inadequate clothing was found to be associated with an increased risk of hypothermia. Similar observations have been seen in Katmandu, where Johanson reported that a cold environmental temperature and being inadequately wrapped were significant factors.[7,8] This study shows that even in warm environmental temperatures, inadequate clothing is associated with hypothermia. It is known that heat loss is nearly five times higher in wet and exposed infants as compared to infants who have been dried and warmed.[9]

The time taken for transfer from the place of delivery to the neonatal unit was significantly associated with hypothermia. The time ranged from six minutes to nearly three hours. The average duration of transfer was 88 minutes. It is possible that these infants were exposed to cold while being transferred. It could also be related to failure of breast feeding and establishing skin to skin contact or the so-called "Kangaroo care."[4,10] This study showed that breast feeding rates during admission were very low, a staggering 2.3%, and may predispose these neonates to hypothermia.[11-13]

The increased risk of hypothermia among low birth weight infants, premature infants and those with asphyxia is well known and it is not different in this study.[8,14-16]

There was a significant association of hypothermia with mortality. Although this study did not establish a direct causal relationship of hypothermia to mortality, the 3.3 higher risk of death cannot be completely ignored. The study done in Ethiopia showed a relative risk of 2.2.[15] Among the 33 infants in the hypothermia group who died, eight (23%) were diagnosed with sepsis. This unit did not have the facilities for blood glucose estimation and therefore hypoglycaemia was not recorded as a cause of morbidity and mortality.

In this study hypothermia was significantly associated with a diagnosis of RDS and this is not easily distinguished from pneumonia on clinical grounds alone. Both these conditions are associated with a high morbidity and mortality in our setting.[20] Hypothermia may not necessarily be due to heat loss, or inability to generate heat. In fact it may be a manifestation of serious bacterial infection in a neonate. Thus detecting cold palms and legs in a neonate should warrant immediate attention, not only for provision of warmth, but also to look for other indications of serious bacterial infection. This concept is utilized in the Integrated Management of Childhood Illnesses for the sick young infant.[21] Algorithms for the diagnosis of serious bacterial infection in the young infant have emphasized looking for hypothermia as an important sign.[22]

The duration of stay in the hospital was longer among the hypothermic infants and this could again be due to various factors, such as poor weight gain and associated morbidity. This in turn will affect the maternal-infant bonding besides being an additional economic burden to the hospital and family.

Conclusions

The prevalence of hypothermia on admission to the Neonatal Care Unit at MMC was 22.4%. Factors significantly associated with hypothermia on admission include delivery at the hospital by Caesarian section, low birth weight, longer duration of transfer to the unit, inadequate clothing. Hypothermia is not seriously considered, and all the admissions , including those with severe hypothermia did not have any mention of their temperature. Moreover, breast feeding rates and skin to skin care was very poor. Hypothermia on admission was associated with increased morbidity, poor post natal weight gain, prolonged stay in the neonatal unit, and increased mortality. There is, therefore, a need to raise awareness among all those concerned about basic neonatal care, especially neonatal hypothermia, kangaroo care and breast feeding.

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