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NEONATAL HYPOTHERMIA IN TEHRAN, IRAN: INCIDENCE, SEVERITY AND DEATH RATE

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ABSTRACT

Background: In 1958, Silverman demonstrated that maintenance of body temperature reduces mortality in low birth weight infants. From the early 1990s it was already recognized that adequate environmental warmth was essential in the case of newborns. However, neonatal hypothermia continues to be a significant issue in developing countries.

Methods: In order to describe the incidence and severity of hypothermia after delivery and to determine the possibility of related mortality risk among neonates in a tertiary nursery, we measured the body temperature on admission of 898 consecutive inborn infants after birth by a low-reading thermometer. Body temperature less than 36.5°C was designated as 'hypothermia'. In such cases the infants were re-warmed according to WHO recommendations. Their body temperature was checked and recorded every hour and their final outcome was noted.

Results: The overall incidence of hypothermia was 53.2%. 456 (i.e., 50.2% of) infants had mild hypothermia (35>T>36.5) while 22 (2.5%) of them had moderate to severe hypothermia (T<35°C). The incidence and severity of hypothermia was found to be significantly associated with birth weight (p= 0.000) and gestational age (p= 0.000). The duration of re-warming was also correlated with birth weight (p= 0.000). Logistic regression analysis showed that the mortality rate of hypothermic neonates is 3.64 times that of the normotherms. The risk of death was higher in the moderate to severe hypothermic groups than in the mild hypothermic infants.

Conclusion: In our study, the incidence of hypothermia was found to be high with both the incidence and severity to be significantly associated with birth weight and gestational age. The risk of death was recognized to be higher in the hypothermic newborns than non-hypothermic ones.

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INTRODUCTION

Hypothermia is an important determinant of the survival of newborn infants especially among the low birth weights.[1] An infant loses heat by evaporation, convection, radiation, and conduction.[2] If hypothermia persists there is a risk of neonatal cold injury developing in which case the infant usually becomes lethargic, with slow, shallow and irregular respiration and a slow heart rate corresponding to the degree of fall in body temperature. Hypoglycemia and metabolic acidosis may develop.

Prolonged cold injury leads to edema, generalized hemorrhage (especially pulmonary hemorrhage), jaundice and death. In developed countries awareness of the problem has resulted in improved care of the newborn, and the incidence of neonatal hypothermia is mostly confined to premature and low birth weight infants. Hazan et al (Canada, 1991) reported that the overall incidence of hypothermia (T<35°C) on admission among VLBW infants was 11.5-12.5%.[3] And in a retrospective study, by Loughead et al (USA, 1997), 45% of outborn VLBW infants were found to be hypothermic (T<36.3°C) on admission.[4] On the other hand, Takayama et al (USA, 2000) revealed that 17% of 203 healthy full term infants had axillary temperature 36.3°C after birth.[5] However, in many parts of the world this is not the case and the extent and significance of neonatal hypothermia are often not fully realized. Many health personnel are not aware of the importance of keeping babies warm by simple methods such as drying and wrapping immediately after birth, avoiding harmful practices, encouraging early breast feeding and keeping newborns in close contact with their mothers.[6] According to WHO reports, studies in India, Ethiopia, China and Nepal have shown that most of the newborns became hypothermic soon after birth.[6]

This prospective study aimed at showing the incidence of hypothermia after admission of inborn infants and determining its mortality risk. We also sought to measure its severity and show its possible effect on the death rate of low birth weight and normal birth weight infants as well as the duration of re-warming and its association with birth weight.

PATIENTS AND METHODS

All the inborn infants who were examined in this study during April 2001-April 2002 consisted of those who entered the neonatal unit comprising levels I, II and III nursery care (at Vali-e-Asr Hospital). An analysis of the infants' charts was conducted to evaluate rectal temperature on admission (T_0), sex, birth weight, gestational age, APGAR score, route of delivery and mortality rate. Times of birth and admission were also recorded. The rectal temperature of each infant was measured using an Omron MC-38 low reading thermometer by trained nurses.

Hypothermia was defined as core body temperature below 36.5°C.[7] The severity of hypothermia was classified in the following manner: 35-36.4°C as mild and body temperature less than 35°C as moderate to severe.[6] If the infant was hypothermic, she was re-warmed according to the WHO recommendations[6] while checking and recording her/his body temperature every hour (T_1-T5). The final outcome was also noted. Collected data were analyzed by SPSS software through statistical tests such as chi-square and logistic regression analysis. A p-value < 0.05 was considered significant.

RESULTS

A total of 898 newborns were examined. The overall incidence of hypothermia was 53.2% (478 hypothermic, 419 non-hypothermic) (Table I). The mean time from delivery to admission temperature was 20 minutes and was not significantly different for hypothermic and non-hypothermic infants (p>0.05). The smallest birth weight group (less than 1000 grams) had the lowest temperature on arrival in the unit (p= 0.000) (Table I).

Hypothermia was significantly more frequent in the lower gestational age with 85.2% in gestational age<29 weeks and 45.4% in GA>38 weeks (p= 0.000) (Table I). The mean temperature of all infants was 36.25°C while that of the ELBW group was 35.58°C. Of the 898 infants examined, 456 (50.8%) had mild hypothermia while 22 (2.5%) of them had moderate

Table I. The rate of incidence and severity of hypothermia by weight and gestational age (in percent).

Weight (g)	**<1000**	**1000-1499**	**1500-2499**	**>2500**	**Total**	***p***
Rate of Hypothermia	84.6	80.0	64.1	43.3	53.3	0.000
Mild	69.2	72.3	58.7	45.0	50.8	
Moderate to severe	15.4	7.7	5.3	0.3	2.5	
Gestational Age (weeks)	**<29**	**30-33**	**34-37**	**>37**	**Total**	***p***
Rate of Hypothermia	85.2	69.8	54.9	45.4	53.3	0.000
Mild	70.4	66.0	52.0	44.8	50.8	
Moderate to severe	14.8	3.8	2.9	0.6	2.5	

Table II. The rate and odds ratio of death, in mild hypothermia, moderate to severe hypothermia and normothermia (in percent).

Temperature	Rate	Odds ratio	CI
<35 °C	42.1	26.7	8.98-79.42
35-36.4 °C	7.6	3.03	1.51-6.06
>36.5 °C	2.7	0	0

to severe hypothermia (Table I).

The severity of hypothermia, as well as its incidence, was noted to be higher among smaller and younger infants (Table I). The increase in body temperature after one hour of admission was found to be associated with birth weight (p= 0.000). However, during this study 53 (6% of) infants went on to die. There was an association between hypothermia and the death rate (p= 0.000). Although there were 2 hypothermic & non-hypothermic infant groups, both were matched regarding sex, method of delivery & five minutes APGAR score less than six.

The risk of death among hypothermic infants was 3.64 times that of normothermic ones (CI= 1.89-7.18) (Table II). In order to eliminate the effect of gestational age & birth weight on growing hypothermia incidence, the logistic regression analysis was used. Logistic regression analysis demonstrated the association of neonatal mortality with the severity of hypothermia. The risk of death among mild hypothermic newborns turned out to be 3.03 times that of the normotherms (CI=1/51-6/06), while the odds ratio of death for moderate to severe hypothermic infants was 26.7 (CI=8/98-79/42) (Table III). The study also showed that after one hour of admission 118 infants continued to be hypothermic, and that re-warming of one newborn took up to 5 hours (Fig. 1).

DISCUSSION

Thermal management has a key role in neonatal nursing care due to the poor outcome of hypothermia. Severe complications of hypothermia thus reported included the fol-

Table III. Comparison of hypothermia in different countries.

Study	Developed countries				Developing countries		
	Canada[3]	**USA**[4]	**USA**[5]	**Australia**[14]	**Nepal**[12]	**Zambia**[11]	**India**[13]
Year	1991	2000	1997	1997	1993	1995	1998
Authors	Hazan J, et al	Loughead, et al	Takayama JI, et al	Bowman ED, et al	Johnson RB, et al	Christensson K, et al	Kumar R, et al
Definition of Hypothermia	Axillary Temp. <35°C	Axillary Temp. <36.3°C	Body Temp. <36.3°C	Axillary Temp. <36°C	Body Temp. <36°C	Body Temp. <36°C	Axillary Temp. <35.6°C
Number and characteristics	559 VLBW Inborns* & outborns**	199 VLBW outborns	203 fullterm inborns	All* newborns and ELBW** (during transport)	500 inborns 2 hours after birth	261 outborns in 0-7 days of life	189 term healthy babies delivered at home, 24 hours after birth
Incidence of hypothermia	*11.5%† **12.5%	45%††	17%†††	*17% **36%	85%††††	44%	19% in winter 3% in summer
Comparison with our study	†9.8% in our study (with the same characteristics and temperature of the described study) ††71.4% in our study (with the same characteristics and temperature of the described study) †††45.3% in our study (with the same characteristics and temperature of the described study) ††††35.3% in our study (with the same characteristics and temperature of the described study)						