Brief Reports

Effects of Thermal Environment on Neonatal Thermoregulation

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Newborn babies are partial poikilotherms. They are prone to thermal stress by environmental factors like humidity, air drafts, conductivity, ambient temperature and other climatic conditions(l). This study was done with the objective of determining the effects of various environmental thermal conditions like temperature, humidity, air currents and room temperature on neonatal thermoregulation under local conditions. Contributory factors including prematurity, low birth weight and illnesses were also considered.

Subjects and Methods

This prospective study was done on 100 inborn newborn babies admitted in Postnatal Wards and Neonatal Intensive Care Units (NICU) of a teaching referral hospital. Cases were selected randomly throughout the year. These were divided in 4 groups of 25 each. The first group included full term well babies, the second group included preterm babies of various gestation, the third group included small for gestational age (SGA) babies and the fourth group had babies with various high risk factors like birth asphyxia, sepsis, post operative status, *etc.*

Rectal and skin temperatures of all babies were recorded every 4 hours from birth to 36 hours of age. Room temperature and humidity (by hair hygrometer) were recorded 4 hourly. A daily record of maximum and minimum temperatures was kept through out the year. Clothing alone, bakery lamp, radiant warmer or incubator were used as warming interventions as per the need of individual baby. Only 17% of babies were nursed in incubators, 22% in radiant warmers and 36% under Bakery lamp while 25% did not need any heating device. The effects of all variables in combination and individually were analyzed by regression analysis. Significant factors for each variable were studied for each four hour slot.

Result

Full term AGA babies had significantly lower mean body temperatures during the first 12 hours, ($p < 0.003$). Low birth weight (< 1500 g) and SGA babies also had lower temperatures during the first 12 hours ($p < 0.007$). These babies maintained normal body temperatures after 12 hours irrespective of the heating intervention used. Babies with Hypoxic Ischemic Encephalopathy (HIE) also had significantly lower mean temperatures during the first 12 hours *(Table I)*.

Eight preterm babies <34 weeks, 13 low birth weight infants < 1500 g, 12 SGA babies and 4 babies with HIE recorded rectal temperatures below 36°C during first 12

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hours. Univariate analysis identified gestational age < 34 weeks, birth weight < 1500 g, SGA and HIE as high risk factors for hypothermia.

The mean body temperatures were significantly lower during the winter months of November to February. The mean minimum environmental temperatures were statistically lower during this period. The mean room temperatures were almost the same throughout the year. Humidity was low during the summer months *(Table II).*

Discussion

During the first 12 hours of life, full term SGA, low birth weight (< 1500 g) and preterm babies had significantly lower mean body temperature. This observation is consistent with earlier reports(2,3). Preterm babies are at a disadvantage because of their larger surface area, thin skin, less subcutaneous fat and less brown fat(4). SGA and low birth weight babies have

TABLE I—*Mean Body Temperatures at Different Hours of Life in Various Intervention Groups.*

Intervention Group (NQ.) (Total 100)	Mean body temperaturs in °C		
	<12h	12-24 h	24-36 h
Full term AGA (25)	36.71*	36.89	36.96
Preterm (25)	35.87*	36.80*	36.82
SGA (25)	35.67*	36.56	36.92
High risk factors			
HIE (10)	35.15*	36.15	36.64
Surgery (4)	36.35	36.87	36.74
Sepsis (6)	36.15	36.19	36.42
Others (5)	36.07	36.40	36.22

* Significant with p value of < 0.05

TABLE II-*Mean Body Temperatures of All Babies and Various Environmental Factors.*

Season	Mean body temperature (°C)	Mean environmental temperatures (°C)		Mean room temperature (°C)	Mean humidity (%)
		Maximum	Minimum		
Winter (Nov-Feb)	35.91*	28.97	11.27*	24.02	86
Summer (Mar-Jun)	36.35	35.55	19.77	25.12	50*
Monsoon (Jul-Oct)	36.26	29.25	20.62	24.18	89

* Significant with p value of < 0.05

slower metabolic response to hypothermia. They have less brown fat and inadequate utilization of amino acids and other glucose substrates(5). Babies with HIE also had lower temperatures during first 12 hours. This observation is consistent with an earlier study(6). These babies are exposed to thermal stress during resuscitation and transport. Hypoxia and ischemia can result in altered metabolic response to thermal stress(5).

When babies who recorded episodes of hypothermia with temperature below 36° C were analyzed for individual risk factors, Gestational age < 34 weeks, birth weight < 1500g, SGA and HIE were identified as individual high risk factors for hypothermia. These finding are consistent with earlier observations(7).

The mean room temperature in the NICU and Postnatal Wards were almost the same throughout the year. Room heaters or fans were used in these rooms, as appropriate, to maintain an average room temperature of 24° C. In Pune city, the average minimum temperatures were significantly lower during winter season. Babies had lower mean body temperatures during the first 12 hours during these months. The average humidity was significantly lower only during summer. This did not adversely affect the mean body temperatures.

As warming devices, we used bakery lamps in babies weighing > 1500 g and gestational age of > 34 weeks and servo controlled radiant warmers or incubators in babies weighing < 1500 g, gestational age < 34 weeks and seriously ill infants. Babies in all intervention groups had normal body temperatures after 12 hours of age. We feel that bakery lamps can be used effectively as low cost technology for themoregulation in Level II care units.

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