# Temperatures of extreme low birth weight infants at a tertiary center neonatal unit: a descriptive, retrospective study

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## Abstract

The consequences of cold stress and severe hypothermia are well known. The frequency of low admission temperatures <35°C to the NICU varies widely among neonatal centers with rates as much as 40% in infants <26 weeks gestation.

The purpose of this report is to describe the frequency distribution of admission temperatures in extreme low birth weight infants (ELBW) in our tertiary care NICU. The correlation of mean admission temperature and both birth weight and gestational age was also examined.

A retrospective descriptive study conducted in King Khalid University Hospital-NICU, including 50 consecutive extremely low birth weight infants (<1000 g at birth), delivered between December 2004 to September 2007. Data gathered included birth weight, gestational age, mode of delivery and admission temperatures.

The mean admission temperature was 35.59°C±0.88°C (range=33.0-36.8°C). 84 % (n=42) of the study population had admission temperatures <36.5°C. The frequency of admission temperatures <35.0°C and <36.0°C was 18% and 52%, respectively. There is almost a linear correlation between mean admission temperature and both birth weight and gestational age.

The frequency of low admission temperature <36.5°C is significantly high in our unit (84%). This calls attention to the need to review and apply evidence-based practice with regard to thermal management especially for the most vulnerable premature infants.

## Introduction

The normothermic hypothesis set off what is to be one of the most significant advances in the care of the very low birth weight infants (VLBW) [<1500 g at birth].

Stemming out from the two early studies by Silverman and others [1,2], it was pointed out that the survival of premature infants in the first 5 days of life would be favorably influenced by environments that maintained their normal body temperatures, it marked the threshold where strict thermoregulation of preterm neonates began to be accepted as standard of care.

At birth, the neonate has to strike a balance between its capacities to generate heat, and the imminent processes of heat loss if it is to successfully transit from intrauterine to extrauterine life. However, even the initial delivery room resuscitation may impede with this balance, and heat loss overwhelms the limited capacity of the preterm infant for heat production. The urgency of the initial resuscitative procedures often takes precedence over the attention given to thermoregulation inevitably leading to a hypothermic admission temperature.

The VLBW infant, with its limited to absent ability for non shivering thermogenesis, thin skin, very little body fat, posture that exposes most of its body surface and the requirement for more stabilization procedures, make it the most vulnerable to hypothermia [3].

The World Health Organization (WHO) clearly defines normal newborn temperature to be between 36.5-37.5°C (97.7-99.5°F). Furthermore, it classifies that cold stress as occurring between 36.0-36.5°C, moderate hypothermia at 32.0-36.0°C, and severe hypothermia at <32°C [4]. The consequences of severe hypothermia are well known. It leads to a vicious cycle of severe hypoxia and acidosis that result in a failed adaptation to extrauterine life and death [3]. It has been shown to be independently associ-ated with death and predictive of oxygen dependency in infants <26-week of gestation [5]. Furthermore, association between low admission temperature and both late-onset sepsis and in-hospital mortality have been demonstrated [6]. The impact of hypothermia on neonatal out-comes is emphasized more as it is included in the SNAP (score for neonatal acute physiology) scoring system [7].

Currently, standard of care includes providing a warm delivery room at a minimum of 25°C, drying the infant thoroughly especially the head, removing any wet blankets, wrapping in a prewarmed blanket, prewarming con-tact surfaces, eliminating drafts, and use of radiant warm-ers if available [8]. The newer interventions including polyethylene wraps, skin-to-skin care, and transwarmer mattresses are all effective in preventing hypothermia on admission to the NICU but are not yet standard of care [9]. The frequency of low admission temperatures <35.0°C to the NICU is shown to vary within a fairly wide range of 14.3% in a cohort of infants 401-1499g up to as much as 40.4% in infants <26 weeks gestational age [5,6].

The purpose of this report is to describe the frequency distribution of admission temperatures in ELBW infants (<1000 g at birth) in our tertiary careNICU as part of a quality improvement initiative. The correlation of mean admission temperature and both birth weight and gestational age was also examined. Finding of significant hypothermia on admission will prompt a review of present practices, and possibly adoption of newer practices and then reevaluation.

## Methods

A descriptive, retrospective study was conducted in King Khalid University Hospital (KKUH) tertiary care NICU. Fifty ELBW infants, delivered in the period of December 2004 to September 2007 were evaluated. Subjects were identified from the NICU admission logbook followed by a detailed data collection from patient's medical and nursing records. Data gathered included birth weight, gestational age, mode of delivery, and admission temperatures. Axillary temperature measurement is the standard of care in our unit.

Normally distributed data (gestational age, birth weight, and admission temperatures) were expressed as mean, range and standard deviation. Skewed data were expressed as median (interquartile range). Mean admission temperatures were correlated with gestational age and birth weight.

## Results

Between December 2004 and September 2007, 50 ELBW infants were delivered and admitted to KKUH-NICU. The mean gestational age was 27±2 weeks (range=23-34 weeks). The mean birth weight was 0.810±0.14 kg (range=0.455-1.0 kg). Admitted infants were delivered by emergency CS (46%, n=23), spontaneous vaginal delivery (30%, n=15), assisted breech delivery (18%, n=9) and elective CS (6%, n=3), respectively (Table 1).

The distribution of admission temperatures demonstrates that the frequency of temperatures <35.0°C-36.0°C are 18% and 52%, respectively. The highest percentage of low admission temperatures (<35.0°C and <36.0°C) are seen with the lower gestational ages 23-25 weeks (Table 2). The same observation was also noted for infants with lower birth weights.

The mean admission temperature was 35.59°C±0.88°C (range=33.0-36.8°C). Hypothermic admission temperature <36.5°C was found in 84% of the study population. The frequency distribution of admission temperatures is shown in Figure 1.

The mean admission temperature and both gestational age and birth weight showed almost a linear relationship with the mean admission temperature increasing as gestational age increases (Figure 2).

## Table 1. Descriptive Characteristics of the Study Cohort

| Characteristic | Total |
|---|---|
| Gestational Age* (weeks) | 27 ± 2.17 |
| Birth Weight, mean* (kg) | 0.810 ± 0.14 |
| Manner of Delivery, n (%) | |
| SVD | 15 (30%) |
| Emergency CS | 23 (46%) |
| Elective CS | 3 (6%) |
| Assisted Breech | 9 (18%) |

*Mean SD

**Figure 1:** Frequency Distribution of Admission Temperatures

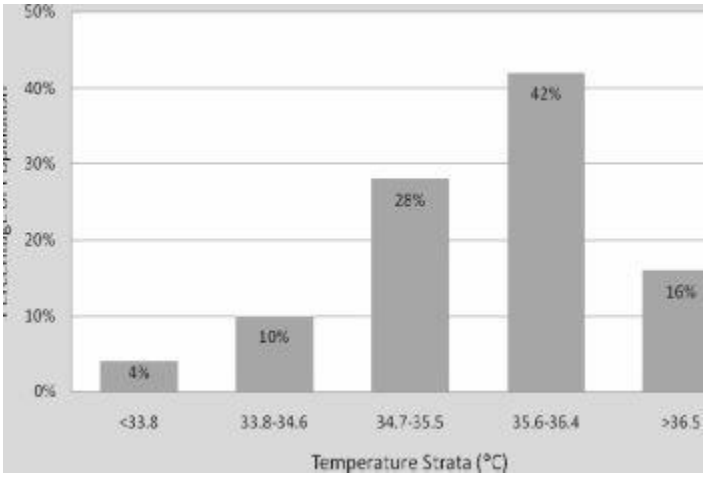
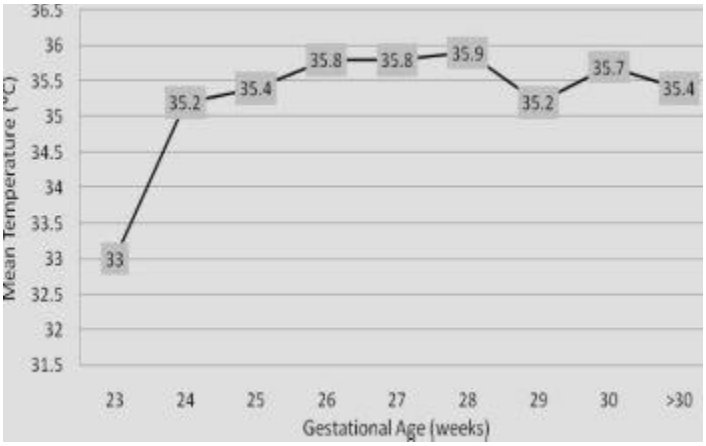



Table 2. Distribution of Admission Temperatures <35.0°C and <36.0°C According to Gestational Age

| GA | n | <35.0°C | <36.0°C |
|---|---|---|---|
| 23 | 1 | 1(100%) | 1(100%) |
| 24 | 4 | 1(25%) | 2(50%) |

| | | | |
|---|---|---|---|
| 25 | 5 | 1(20%) | 4(80%) |
| 26 | 13 | 2(15%) | 5(38%) |
| 27 | 8 | 1(12%) | 3(38%) |
| 28 | 6 | 0(0) | 2(34%) |
| 29 | 6 | 2(34%) | 5(84%) |
| >30 | 7 | 1(14) | 4(56%) |
| Total | 50 | 9(18%) | 26(52%) |

**Figure 2:** Correlation of mean admission temperature and gestational age




## Discussion

Admission with low body temperatures remains a significant medical problem for VLBW infants. The fact that the more premature is the infant, the more likely he/she is to be hypothermic on admission reflects their physical characteristics and the need for more stabilization procedures [10]. Furthermore it reinforces the fact that birth weight is an important determinant of admission temperature with increasing mean admission temperature by 0.21°C with each 100 g increase in birth weight [9].

Despite the wide variation in frequency of <35°C and <36°C admission temperatures presented in the literature, our local figures are quite comparable to the recently published data out of the Neonatal Research Network in a large cohort of infants with birth weights between 401-1499g [6].

Typically the mean admission temperature has linear correlation with gestational age or birth weight. The investigators of the EPICure study noted that low admission temperature (<35 °C) varied widely in extreme preterm infants between 21-25 weeks gestation with reported frequencies of 67%, 80%, 59%, 43% and 30% [5]. Similar linear correlations between birth weight and mean admission temperature was seen in the study by the Neonatal Research Network [6]. Our data showed a good linear correlation between gestational age and mean admission temperature from 23 to 28 weeks. However, for the 29-30 weeks gestational age, the correlation is staggered. The correlation we have seen between mean admission temperature and birth weight is linear except for the peak seen in the smallest birth weight strata. The failure of a perfect correlation may reflect inconsistency in temperature measurement practice in our unit.

Our findings in addition to the published data, calls for a careful review of resuscitation practices especially thermal control directed at the most vulnerable extreme pre-term infants. The present standard of care thermal management

of newborns during the initial stabilization is clearly specified by the World Health Organization guidelines [4]. However, fact remains that in the initial stabilization of the low birth weight infants, the thermoregulatory practices are put in the background as more urgent stabilization procedures are carried out in the foreground. The findings also support the adoption of recent interventions to prevent hypothermia such as polyethylene wraps and transwarmer mattresses which have been proven effective and relatively safe [8].

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