GE Healthcare

From birth to neonatal unit: a cold journey?

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Maintaining thermoregulation from birth is a vital and important part of newborn resuscitation. The Giraffe* OmniBed* combines the features of an incubator and a radiant warmer. Hence, this allows a full range of resuscitation and clinical procedures to be performed without the disruptive intervention of transferring a sick baby from one bed to another.

Minimizing Heat Loss at Resuscitation

Being prepared, with appropriate equipment, is possibly the single factor most likely to influence a successful outcome. Body temperatures of infants can fall dramatically if measures are not taken to conserve heat. It is essential to avoid complications of cold stress, as even mild chilling may double oxygen requirements and significantly impair prospects for a full recovery.

Measures should be taken before and during resuscitation in order to prevent heat losses. In order to decide what measures can be taken, it is helpful to identify why newborn babies lose heat, and then identify how this can be eliminated by the use of appropriate equipment such as the Giraffe OmniBed.

Why newborns are prone to high heat losses

- Incomplete drying of a newborn baby at delivery may lead to an increase in evaporative heat loss. Wet = Cold.
- The more preterm the infant, the thinner the epidermis, and the less subcutaneous fat present.
- Newborn infants have a large surface area compared with their body mass. Convective and radiant heat losses may be increased in an environment not designed to maintain heat.
- Non-shivering thermogenesis from the breakdown of brown fat is the principle method of heat production in the newborn, but even this may be insufficient to compensate for excessive heat losses at resuscitation (Hey, 1969).
- Any baby who is sick, hypoxic, acidotic or infected (i.e., those most likely to require resuscitation) will have a limited ability to increase heat production.

How can heat be lost?

There are four main principles of heat loss in the newborn:

Conduction: To solid objects which the infant comes into contact with (e.g., cold cot mattress/blankets).

Convection: Exposure of the body in inadequately heated and draughty rooms.

Radiation: Of heat onto nearby objects and atmosphere.

Evaporation: Of water from wet skin if not dried adequately or nursed in a humid environment.

Thermoregulation

The hypothalamus is underdeveloped in preterms leading to poor vascular control. Evaporative heat loss may be up to 3-5 times greater in 26 week gestation infants than in 31-32 week infants. This is of particular significance when infants are born in a cool labour ward and wet from amniotic fluid, then transferred via draughty corridors to neonatal units.

Convective heat losses occur when warmth is lost to surrounding air or water. Therefore, infants should be transported though cool hallways in incubators with portholes closed.

Ultimately, nursing care is aimed at promoting and facilitating the neutral thermal environment.

Potential Risks of Heat Loss in Infants

Excessive heat loss can exacerbate:

- Depletion of surfactant – particularly in preterm infants
- Hypoxia and increased oxygen consumption
- Hypoglycaemia
- Metabolic disorders
- Increased utilisation of calorific reserves
- Acidosis
- Increased neonatal morbidity

Strategies to Reduce Heat Loss During Resuscitation

- Warm environment in delivery suite (ideally 25° C)
- Draught free environment
- Warm dry towels to dry the baby at delivery
- Warm resuscitation surface with radiant heater switched on
- Warm transportation incubator if transferring to the neonatal unit

Problems Encountered During Transport

The Environment: Both noise and movement may cause difficulties, as well as low ambient temperatures, particularly in winter. These factors may interfere with clinical and electrical monitoring of the baby.

The Equipment: Dependent on local policy, infants may be transported on Resuscitaires or via transport incubators. This may lead to excessive handling or dislodged tubes etc. There may also be potential problems with oxygen, air or power supplies.

The Baby: Premature and sick infants are the ones most likely to need transfer to the neonatal unit, and are particularly vulnerable to the hazards of cold stress and excessive handling.

The Giraffe OmniBed combines the features of an incubator and a radiant warmer. When used as an incubator, a fan and heater beneath the bed circulate warm air thorough the closed infant compartment. The baby can be accessed through portholes or doors. When you require even greater access to the baby (as in the resuscitation situation), the canopy can be raised and compartment walls lowered. This action exposes a focused radiant heating element inside the canopy that maintains the baby's temperature like a warmer (Figure 1).

The obvious benefit of this will be in the situation where the resuscitation of a small infant is inevitably going to lead to admission of that infant to the neonatal unit. Figure 2 demonstrates the ability of the OmniBed to do the "complete package."

Minimal Handling Techniques

The modern neonatal unit and delivery suite employs increasing technology designed to keep an infant's condition optimal and stable with minimal disturbance (Appleton, 1997). Studies have suggested that these developments have resulted in improvements in the outcome of very low birthweight infants (Kitchen et al, 1982). Unfortunately, today's environments are also very busy working environments and consequently infants are

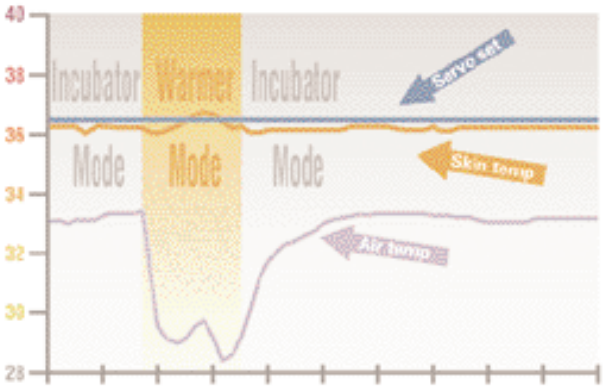

Figure 1

Giraffe in transition. This was the thermal data generated by a 605-gram infant as she experienced transition from incubator to radiant warmer to incubator over one hour. The dark blue line at the top of the graph marks the baby's servo set point @ 36.3°C. The orange line is the baby's measured skin temperature. The light blue line at the bottom of the graph marks the incubator air temperature. One would expect that the air temperature would drop down whenever the canopy lid is opened as the Giraffe is no longer operating as a convective incubator and the Giraffe radiant heater takes over thermoregulatory control. The canopy of Giraffe was opened at 22.16 hours of life and remained open for fifteen minutes. As you can see, the infant's body temperature remained extremely stable throughout the intervention.

Figure 2

Minimizing cold stress in the newborn infant.

delivered into and reared in bright noisy neonatal rooms and handled frequently. Research suggests that current neonatal environments may exert adverse iatrogenic effects on preterm and sick neonates, which may hamper their recovery and healthy development (Horsley, 1990).

Pre-planned nursing and medical intervention and ensuring care is individualised to an infant's needs is imperative in opening a more comprehensive and individualized perspective on neonatal resuscitation and subsequent transfer and intensive care. Placing traditional medical procedures into a developmentally appropriate framework of care will benefit the smallest and sickest of infants and help to reduce the financial cost of neonatal intensive care as infants recover faster and develop more optimally (Appleton, 1997).

Premature infants are unable to cope with stressful experiences due to their immaturity and lack of physiological reserves. Excessive handling is known to increase stress and oxygen consumption of preterm infants and they therefore can be compromised by touch.

Humidifying the Environment

From conception to birth, the developing fetus is nurtured in the warmth of its mother's body. At birth, heat exchange through the placenta abruptly ceases, and heat loss becomes an ongoing threat to survival. Due to the thin, poorly developed epidermis and a relatively large surface area in relation to body weight, premature infants lose large amounts of heat by the passive process of evaporation known as transepidermal water loss.

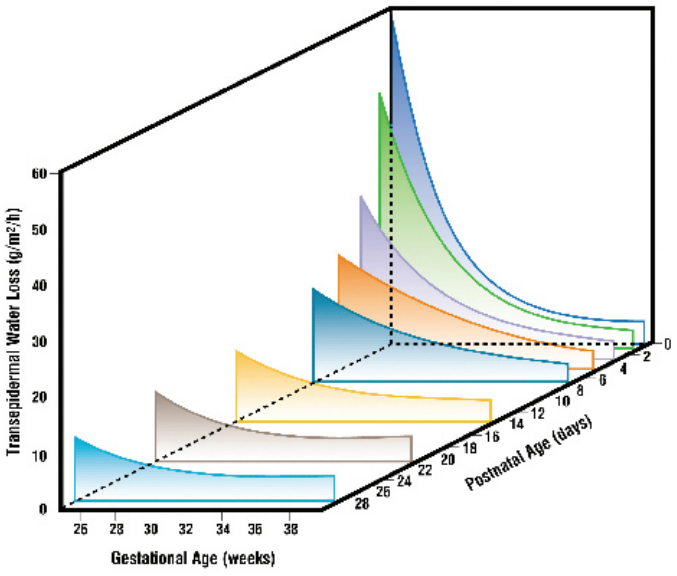

Figure 3

Transepidermal water loss in infants <28 weeks gestation nursed in unhumidified incubators compared with term infants.

Substantial reduction in evaporative heat loss can be achieved by adding high levels of humidity to the air surrounding the infant. It is recommended that additional humidity be used for all infants below 30 weeks' gestation, below 1 kg birth weight and during the first week of life (Marshall, 1997) (Figure 3).

Creating and maintaining a humidified environment inside an incubator is easily achieved, but to achieve these conditions for a baby under a radiant warmer can be a difficult and cumbersome task.

Linking Technology and Caring

Technology has become an inevitable and necessary feature of intensive care areas. Expert nurses see past the technology and focus on the patient, using the technology to improve patient care and outcomes.

When used appropriately, technology can enhance best practice by increasing the ability of carers to respond to the need of infants in their care (Graham, 2001).

Many argue that technology is unnecessarily costly and impedes nursing care. However, it could be argued that if technology is used properly and within the scope of its intended function, it can be cost effective and enhance nursing practice (Graham, 2001).

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