Thermoregulation in Very Low Birth Weight Babies

The normal body temperature of full terms infants is 36.5-37.5°C~97.7-99.5°F. Newborn infants are most sensitive to hypothermia during the stabilization period in the first 6-12 hours after birth. Hypothermia is an important complication of prematurity especially in very low birth weight babies (VLBW). Newborns go through different physiological changes after birth including temperature regulation. At birth, rapid drop in body temperature of both premature and term infants leads to debilitating effects on newborns in the immediate neonatal period. It may lead to long term developmental outcomes which are still not evident in literature. In 1993 WHO made a statement “Hypothermia in the newborn is more due to lack of knowledge than lack of equipment.” In 2000 the American Academy of Pediatrics (AAP) made a statement that Physicians who resuscitate newborns may be so focused on achieving oxygenation and a good cardiac output in the stress of the resuscitation, they overlook temperature control. A team at the delivery of the most preterm babies can ensure that one team member has a lead role in thermal care. Newborns lose heat through skin by various methods namely, convection, conduction, evaporation and radiation. The delivery room temperature must be kept at 25°C ~ 77 °F higher, but it is too warm for the comfort of parents and nursing staff, so it is often kept lower than it should be for the babies. When exposed to the cold atmosphere at birth, newborns core body temperature decreases which leads to stimulation of peripheral and central thermoreceptors, which leads to stimulation of cerebral cortex. Adults respond to this cold stress by diminished heat loss, initiation of shivering and diminished sweating which contributes to increase heat production. Whereas newborns physiological response to cold is not mature, they cannot shiver to generate heat– the only response they have is sweating which contributes to increase heat production. Adults respond to this cold stress by diminished heat loss, initiation of shivering and diminished sweating which contributes to increase heat production. Whereas newborns physiological response to cold is not mature, they cannot shiver to generate heat– the only response they have is sweating which contributes to increase heat production. 

Premedication for Neonatal Endotracheal Intubation in Neonates

Endotracheal intubation is a commonly performed procedure in the Neonatal Intensive Care Unit (NICU). It needs to be performed expeditiously without causing significant adverse events. Successful intubations frequently require more than one attempt and failed attempts are often attributed to suboptimal intubating conditions. Endotracheal intubation is a painful procedure for both preterm and term infants. However, it is difficult to demonstrate behavioral responses to pain in newborns, unlike adults and children. Preterm infants who undergo painful procedures have periods of hyperalgesia, during which even non-noxious stimuli can cause significant pain. Hemodynamic changes induced by pain can contribute to the development of intraventricular hemorrhage or periventricular leukomalacia. The consensus statement from the International Evidence-Based Group for Neonatal Pain states that “Tracheal intubation without the use of analgesia or sedation should be performed only for resuscitation in the delivery room or for life-threatening situations associated with the unavailability of intravenous access.” Despite this recommendation, endotracheal intubation is performed without the use of analgesics in the majority of NICUs worldwide.

Common adverse effects of endotracheal intubation include bradycardia, an elevation in blood pressure, and trauma to the airways. Airway injury can range from minor oral cavity bleeds to esophageal perforation and vocal cord damage. Intubations are known to increase intracranial pressure, which can trigger intraventricular hemorrhage.

Commonly used drugs for procedural premedication include sedatives/analgesics, paralytics, and anti-cholinergics. Opioids, such as fentanyl, morphine, and remifentanil, are frequently used for neonatal pain and for their sedating properties. Morphine acts within five minutes of administration with a peak effect at 30 minutes. This relatively long latency in the onset of action makes morphine a non-preferred analgesic for use as premedication. Conversely, fentanyl and remifentanil exhibit shorter onsets of action and rapid peak analgesic effect. However, the use of rapid acting opioids incurs a higher risk of chest wall rigidity, a potentially dangerous side effect of these medications best prevented by gradual intravenous administration and use of neuromuscular blocking agents. In addition to opioids, benzodiazepines (eg. midazolam) and anesthetics such as propofol and thiopental have been used in recent clinical trials in both premature and term infants. These medications are effective.

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sedatives in newborns but are associated with hypotension. Indeed, midazolam, propofol, and thiopental are not routinely used in premature infants. Paralytic agents also may be used to facilitate intubation and can simultaneously prevent the rise in intracranial pressure associated with this procedure.\(^6\) Commonly used paralytics include succinylcholine and vecuronium. These medications are always used in conjunction with sedatives/analgesics. Succinylcholine, a depolarizing paralytic, has a rapid onset and short duration of action. Common adverse effects of succinylcholine include bradycardia, thus requiring coadministration with atropine, in addition to hyperkalemia and malignant hyperthermia.\(^6\) Vecuronium, a non-depolarizing paralytic, also has a short duration of action (30 minutes) and does not exhibit the side effects associated with succinylcholine. In addition to prevention of bradycardia with succinylcholine usage, anticholinergic drugs like atropine and glycopyrrole may also be used to alleviate oral and nasal secretions.

In conclusion, premedication for neonatal intubation reduces the adverse effects of this procedure, alleviates pain, and diminishes associated sequelae. Hence, analgesia/sedation is recommended for non-emergent neonatal intubation. Based on current evidence, fentanyl or remifentanyl are highly efficacious in achieving this goal. For non-emergent neonatal intubation. Based on current evidence, fentanyl or remifentanyl are highly efficacious in achieving this goal.

In 1999 Vohra used polyethylene occlusive wrapping to reduce heat loss in VLBW infants (<28 weeks gestation) immediately after delivery. 18 infants had a rectal temperature 1.9 °C warmer than control (P<.001), with no significant difference between 28 to 31 weeks gestation.\(^6\) In 2004, a randomized controlled trial of 55 infants <28 weeks, had rectal temperature of 36.5 ± 0.8°C, compared with 35.6 ± 1.3°C for the unwrapped group (P=.002), but 1 hour later, temperatures were similar in the two groups.\(^6\) A French study in 2002 involving 120 infants <33 weeks gestation wrapped with polyethylene showed a significant difference in admission temperature between these 2 groups (difference in means = 0.8 degree °C, p < 0.0001)\(^n=16\). In 2005, Knobel and colleagues found reduced hypothermia after wrapping babies who were born at <29 weeks gestation\(^11\). Hats reduce heat loss in terms newborns but studies have not been done in babies who were born at less than 32 weeks gestation\(^13\).

Samran found no difference in temperature between those who were kept in air heated incubators and those who were nursed on warm mattresses for up to 3 weeks (mean gestational age=32 weeks; BW= 904 to1980 g)\(^13\). In 2001, L'Herault et al. reported an observational study in which VLBW infants transported on Transwarmer mattresses showed greater increase and stability in body temperature than those without the mattresses\(^14\). Pinheiro evaluated the effectiveness of chemical warming packs during delivery room resuscitation of VLBW newborns. He found that the mean admission temperature at NICU was significantly lower with use of chemical warming packs 39 % vs. 68%\(^11\). Kangaroo care was introduced in 1970 at Colombia for stable babies. Skin-to-skin contact kept them warm in the absence of incubators. It reduces cross infection and foster mother–child bonding. A meta-analysis reported improved temperature control, based on a single, nonblinded study of 51 well, term infants who weighed more than 2500 g\(^16\). The Regional NICU at Maria Fareri Children's Hospital at Westchester Medical Center has a Thermoregulation policy (effective since July 1982), Salient features include: keeping delivery room temperature 76-80 °F (~ 24.4 to 26.6 °C), prewarm radiant warmer, dry and remove wet linen, place hat, providing resuscitation on porta warm mattresses (portable chemical heating blanket) for all the infants < 30 weeks or <1000 grams. We provide skin to skin contact with the mother for stable full term infants. To review the effectiveness of this policy we reviewed the admitting temperature of VLBW infants

Continued from page 1 – Premedication for Intubation

**Premedication for Neonatal Intubation**

<table>
<thead>
<tr>
<th>+/-Anticholinergic</th>
<th>Atropine 0.02 mg/kg IV</th>
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<tbody>
<tr>
<td>Analgesie</td>
<td>Fentanyl 2-4 mcg/kg IV</td>
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<tr>
<td></td>
<td>Remifentanil 2-3mcg/Kg IV</td>
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<td></td>
<td>(Slow IV Push)</td>
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<tr>
<td>Muscle Relaxant</td>
<td>Succinyl choline 1-2mg/kg</td>
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<td></td>
<td>Vecuronium 0.1mg/kg</td>
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<tr>
<td></td>
<td>Rocuronium 0.6-1.2mg/kg</td>
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References:

from 6/30/11 to 1/20/12. A total of 29 subjects with GA 23-29 wks and BW 490-940 grams were included. We found 8 infants had temperature below 35 °C; the lowest temperature was 33.3 °C. Our review showed that although a hospital thermoregulation policy for ELBW is in place, as a matter of practice, the team at the delivery of the most preterm babies has to ensure that one team member has a lead role in thermal care.

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In the News

The following policy statement has been revised:

American Academy of Pediatrics: Circumcision Policy Statement

Task Force on Circumcision
Pediatrics 1999; 103:3 686-693; doi:10.1542/peds.103.3.686


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Task Force on Circumcision

Abstract:
Male circumcision is a common procedure, generally performed during the newborn period in the United States. In 2007, the American Academy of Pediatrics (AAP) formed a multidisciplinary task force of AAP members and other stakeholders to evaluate the recent evidence on male circumcision and update the Academy’s 1999 recommendations in this area. Evaluation of current evidence indicates that the health benefits of newborn male circumcision outweigh the risks and that the procedure’s benefits justify access to this procedure for families who choose it. Specific benefits identified included prevention of urinary tract infections, penile cancer, and transmission of some sexually transmitted infections, including HIV. The American College of Obstetricians and Gynecologists has endorsed this statement.

Policy statement: http://pediatrics.aappublications.org/content/early/2012/08/22/peds.2012-1989


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Screening Newborns for Critical Congenital Heart Diseases (CCHD)

We are interested in providing you with a newsletter that is relevant and of interest to you. Please contact us with perinatal topics you would like to see addressed.

For a copy of our newsletter or to be placed on our mailing list, contact us by phone or e-mail.

Please visit [http://www.westchestermedicalcenter.com/RPC](http://www.westchestermedicalcenter.com/RPC) for information about the Regional Perinatal Center at the Maria Fareri Children’s Hospital at Westchester Medical Center and to locate other issues of The Perinatal Gazette.

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**Why screen?**

**Incidence of CCHD is 9 per 1000 live births.**

- 1-2 per 1000 have life threatening cardiac malformation
- 30% of these infants leave hospital without the malformation being recognized.
- PKU Incidence: 4 per 100,000 live births
- CAH Incidence: 1 per 16,000 live births
- Associated with increased morbidity, hypoxic/ischemic brain injury.
- Under perfusion of systemic circulation

**Increased mortality...when duct closes**

**When to screen?**

**After 24hrs**

- reduce false positives

**When alert and not sleeping**

- rule out hypoventilation

**Pulse oximetry should be a complement to physical examination**

**Protocol**

**Pre-ductal: Right hand**

**Post-ductal: Any foot**