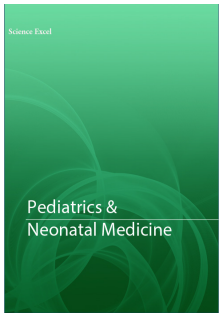
Pediatrics and Neonatal Medicine

Short Communication



Warming Enteral and Parenteral Feeding for Extreme Preterm Infants: An Innovative approach to Neonatal Feeding

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Hypothermia is well described as a major cause of morbidity and mortality, especially among preterm infants. Many routine treatments in the neonatal intensive care units (NICUs) bear heightened awareness of body heat loss and routinely take measures to prevent it. Extreme preterm infants (gestational age <28 weeks) are placed in a polyethylene bag and laid upon a heating mattress immediately after delivery. They are transported to the NICU, kept in well-controlled warm incubators and ventilated with regulated heated humidified airflow systems. Curiously, these measures of providing warmth do not extend to feeding practices, a cardinal aspect of neonatal treatment. Our extreme preterm babies, who are the most vulnerable to heat loss, are fed with enteral and parenteral feeds at room temperature, which is much lower than the targeted core temperature of 37ºC. We propose that warming parenteral nutrition before infusing it intravenously or enterally from syringe to stomach will provide important clinical advantages.

Neonatal thermoregulation and feeding are two cardinal aspects of neonatal care. Every component of the care of extreme preterm infants has a profound effect both on acute and future prognosis. The subject of controlling feeding temperature is sparsely mentioned in the neonatal literature, and there is wide variation in routine practices for preterm and extreme preterm infants. Furthermore, the high levels of awareness for prevention of hypothermia and strategies employed for thermoregulation do not extend to considering possibly significant therapeutic effects of warmth and heat when it comes to both enteral and parenteral feeding.

Premature and, especially, extreme premature infants, sustain complicated medical conditions, such as temperature instability, the need for mechanical ventilation, acidosis, electrolyte imbalance, infections, need for surgery, and various physiologic conditions inherent to prematurity, such as gastrointestinal prematurity, decreased motility, decreased enzyme activity, and exposure to multiple drugs. All of these elements warrant early and appropriate nutritional support in order to prevent medical and feeding complications and to achieve the targeted postnatal weight gain and neurodevelopmental milestones.

When initiating and establishing enteral feeds for preterm infants, clinical studies often address variables such as recommendations of trophic feeds, means and rates of administration, target volumes, feeding schedules, fortification methods, and more. The aspect of feeds temperature is essentially disregarded, and the absence of any guidelines for an acceptable range of temperatures when delivering them to infants is alarming. The situation worsens when feeding is given via a syringe over prolonged times or as continuous feeds.

Warming up feeds is a relatively simple and cost-free intervention. It demands no more than a change in mind set and approach. Ubiquitous intravenous blood/fluid warming systems could easily be adapted to warm feeds. The temperature of formula in a syringe dropped from 38ºC to 25ºC after 45 minutes from the initiation of infusion in our department. The product for total parenteral nutrition is removed from refrigeration at 4ºC and it is infused directly to the bloodstream after warming to a maximum of room temperature.

In addition to the aspect of potential feelings of general comfort, we speculate that there are other important benefits that do not yet lend themselves to clinical assessment. Heat has been applied to promote healing, relieve pain, relax muscles and tension, and more for centuries in different civilizations. It was applied for therapeutic purposes in the Roman Empire, in Chinese medicine (Qi energy), and

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in traditional Persian medicine. It is tempting to consider that such benefits could be bestowed to a greater or lesser degree upon extreme preterm infants as well.

Heating and humidifying the inspired air during neonatal mechanical ventilation is a standard of care, with breathing being associated with a net heat and water loss. Similarly, it is reasonable to assume that a considerable amount of heat is lost when feeding an extreme preterm infant with milk at a temperature lower than core temperature, and even more so when infusing fluids colder than core temperature directly to the bloodstream.

Earlier studies have shown significant benefits of warming feeds in several parameters with regard to non-extreme preterm infants. Uygur and colleagues1 compared the effects of warm milk versus room temperature milk in preterm infants and found that warming enteral feeds reduced the frequency of gastric residuals, apnea of prematurity, and need for anti-reflux treatment. Others have come to similar conclusions of lower rates of gastric residuals and early home discharge when warming preterm infants' enteral feeds.2,3 We now propose that the benefits of warm enteral and parenteral feeds may be more far-reaching, especially when recognizing the holistic quality of heat. We consider that the measurements of the effects and efficacy of warm feeds should extend to feeding intolerance and aspects especially pertinent to the neonatal period, such as an association with necrotizing enterocolitis, the rate of early- and late onset-sepsis, weight gain, timing of NICU discharge, and neurodevelopmental features.

Total parenteral nutrition is another aspect that warrants consideration. Extreme preterm infants consume most of their nutrition intravenously during the first weeks of life. Although the body temperature of those infants is measured continuously and stays constant thanks to warm environmental conditions inside the incubator, it is reasonable to assume that there would be a momentary temperature change of the blood when exposed to cooler influences. The infusion of total parenteral nutrition of a polyuric baby, for example, might cool the body temperature of an extremely preterm infant due to the high daily volumes of cool feed. We are unable to measure this potential change, since we do not measure blood temperature as we do skin and core rectal temperature.

Cold temperature is known to slow down all processes in all human cells including physiologic ones. That is the basis for therapeutic hypothermia and raises the question of whether we are actively putting our extremely premature infants under intermittent cooling conditions by not giving them warm enteral feedings or warmed parenteral nutrition.

Given the above considerations, we propose that the provision of warm feeds, both enteral and parenteral, to our extreme premature infants should be standard of care. Since they cannot suckle warm breast milk from their mothers, it is our responsibility to deliver warm feeds directly to their stomach as well as parenterally. As the advantages of therapeutic heat is well knon and desctribed, togther with the disadvantages of cold environment, neonatologists should further study the potential benefits of providing warm feeds to these infants, and the Neonatal Society should adopt guidelines to encourage its implementation.

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