Therapeutic Hypothermia Is Cool, but Be Aware of the Infection Heat*

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The earliest hypothesis for the effects of hypothermia focused on reducing cellular metabolism. Researchers found that for every 1°C drop in core body temperature, the cellular metabolism is reduced by 5–7%. Therefore, it was thought that by lowering the core temperature one could reduce the harmful effects of ischemia and decrease the body’s oxygen demand (4). Additional theories focused on the relationship of cellular metabolism, glutamate production, and ion homeostasis. In animal models, researchers determined that stores of glucose and adenosine triphosphate are lost within 5 minutes after cardiac arrest. Substrate depletion quickly leads to the loss of transmembrane electrochemical gradients and sequential failure of synapse transmission, axonal conduction, and action potential firing. Consequently, it is not oxygen deprivation itself that is responsible for apoptosis, and cell death, but the inability to make ATP and maintain the cells homeostasis at normal body temperatures. Therapeutic hypothermia may also have neuroprotective effects in preventing reperfusion injury. Reoxygenation initiates chemical cascades producing free radicals that cause lipid peroxidation and other oxidative damage. Various inflammatory immune responses can cause endothelial activation, leukocyte migration, and further tissue injury or susceptibility to infection. Therefore, patients undergoing induction of hypothermia and the rewarming phase must be closely monitored to prevent undesired consequences. Clinicians must be vigilant to avoid overshooting the target temperature as the complications increase in severity, and the risk of adverse events increases at lower temperatures or with rapid fluctuations in the patient’s core body temperature.

Adverse effects of therapeutic hypothermia can be a result of the cooling devices or hypothermia itself. Such events include increased bleeding, infection, deep venous thrombosis, and pulmonary edema (2, 3, 5). In a 2009 study, Nielsen et al (6) conducted an observational study with 986 patients and demonstrated the following adverse effects: pneumonia (41%), hyperglycemia (37%), cardiac arrhythmias (33%), seizures (24%), and electrolyte disturbances (hypophosphatemia, 19%; hypomagnesemia, 18%; and hypokalemia, 18%). These safety issues bring us to this Critical Care Medicine issue, in which Geurts et al (7) performed a systematic review and meta-analysis to evaluate the risk of infections with the use of therapeutic hypothermia. They included 23 randomized trials with a total of 2,820 patients and showed that the overall prevalence of all infections was associated with a nonsignificant 21% increase in infections, but when the authors analyzed the data by specific types of infections, they found a significant 44% increase in the risk of pneumonia and a 80% increase in the risk of sepsis with the use of therapeutic hypothermia. Further, a dose-effect

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Key Words: cardiac arrest; infection; therapeutic hypothermia

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Training Pediatric Rapid Response Teams: The Next Layer?*

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It n 1996, the Institute for Healthcare Improvement suggested implementation of rapid response teams (RRTs) as one of six recommended strategies to prevent inpatient deaths (1). This concept, initially applied to adult care, has now become the standard of practice in pediatric hospitals (2–4). Many pediatric hospitals are now striving to advance the performance of RRTs to improve early intervention and ultimately prevent pediatric arrests (3, 5–9).

Over the past 15 years, cardiopulmonary resuscitation (CPR) effectiveness has also been studied aggressively (10–12). According to 2008 data from the National Registry of Cardiopulmonary Resuscitation, survival rates as high as 33% have been seen with inpatient pediatric pulseless arrest. Not surprisingly, children and infants who received interventions prior to progression to arrest had a 64% survival to discharge (10). Improved RRT performance may help to bolster these needed interventions and therefore yield improved outcomes.