CRITICAL CARE

COMMENTARY

Hypothermia, immune suppression and SDD: can we have our cake and eat it?

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See related research by Kamps *et al.*, http://ccforum.com/content/15/1/R48

Abstract

In vitro studies and clinical observations suggest that both accidental and controlled/therapeutic hypothermia have a strong immunosuppressive effect, and that hypothermia increases the risk of infections, especially wound infections and pneumonia. In the previous issue of *Critical Care*, Kamps and colleagues report that when hypothermia was used for prolonged periods in patients with severe traumatic brain injury in conjunction with selective decontamination of the digestive tract, the risks of infection were the same or lower in patients treated with therapeutic cooling. The risk of infection is widely regarded as the most important danger of therapeutic cooling. The findings of Kamps and colleagues need to be verified in prospective trials and in higher-resistance environments, but raise the possibility of cooling for prolonged periods with greatly reduced risk. We may be able to have our cake and eat it.

In the previous issue of *Critical Care*, Kamps and colleagues reported a surprising observation, one that at first glance contradicts perceived knowledge on therapeutic cooling [1]. Numerous studies have shown that hypothermia can prevent or mitigate ischaemia/reperfusion injuries, and can be used to treat brain oedema [2-4]. There is a growing list of potential indications, although many applications still await evaluation in rigorous clinical trials [4]. In recent years the mechanisms through which hypothermia provides tissue protection have been studied extensively [3]. One key mechanism is the inhibition of a harmful proinflammatory cascade that develops in injured organs following traumatic or ischaemic injuries [3]. Many animal experiments and clinical studies have shown that hypothermia can suppress these harmful inflammatory reactions, and block the release of proinflammatory cytokines [5-8]. Hypothermia can also decrease production of leukotrienes and nitric oxide, prevent reperfusion-related DNA injury and lipid peroxidation, and impair neutrophil and macrophage function. At temperatures <32 to 33°C, hypothermia can decrease the white blood cell count [2,3].

The proinflammatory response, however, is not purely harmful. Some reactions are helpful in tissue repair, and the good may be inhibited along with the bad [9-12]. Moreover, suppression of inflammatory responses occurs in all organs, not just the injured ones, and inhibition of immune response can lead to an increased risk of infections. In this sense, hypothermia is a two-edged sword: the mechanism that provides tissue protection can simultaneously hamper the bodies' ability to fight infections. This problem can be compounded by hypothermia-associated hyperglycaemia, which can further increase the infection risks [3].

Many clinical studies have indeed found higher infection rates in patients treated with prolonged (>24 hours) therapeutic cooling [4]. For example, in a recently published study in patients with ischaemic stroke, the rate of pneumonia was 50% in patients treated with hypothermia versus 10% in controls. Nevertheless, outcomes were better in the hypothermia group, in spite of these adverse events [13]. Most studies on therapeutic cooling have reported trends or significantly higher infection rates in patients treated with cooling, with the risks appearing to increase with longer treatment periods [4]. The increase in infection risk may be even greater with accidental hypothermia [14].

Based on the physiological data and the clinical studies discussed above, some increase in infection risk is usually regarded as an unavoidable consequence of hypothermia treatment. Duration of cooling therapy is often limited because of the (perceived) risk of infections. Few of the clinical trials performed so far, however, have used standard decontamination of the digestive tract (SDD) or other forms of antibiotic prophylaxis in their patients.

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In the previous issue of *Critical Care*, Kamps and coworkers report on their use of prolonged therapeutic cooling to control intracranial pressure in patients with severe traumatic brain injury, in a setting where SDD was routinely used [1]. They compared infection rates in 35 patients treated with hypothermia (median duration 107 hours) with 169 controls matched for severity of injury, age, and other relevant factors. SDD was used in all patients. The overall risk of any infection was 20% for hypothermia patients, versus 34.4% in controls. Most notably, the risk of ventilator-associated pneumonia was the same in patients treated with hypothermia compared with matched controls.

These findings may come as a surprise, but they are in line with two previous studies using prolonged hypothermia in combination with SDD [15,16]. These studies also reported low infection rates in patients treated with hypothermia and SDD, and found that infection rates were the same or lower than in controls.

Many studies have shown that SDD can reduce Gram-negative infection rates, and some have reported reductions in intensive care unit mortality [17]. The findings of Kamps and colleagues suggest that SDD could help avoid one of the most important complications of therapeutic cooling. Their findings need to be confirmed in larger, prospective studies, and the efficacy of SDD in environments with a higher incidence of resistant micro-organisms needs to be determined. The study by Kamps and colleagues provides an exciting starting point, and opens up possibilities for exploring long-term hypothermia treatments.

Abbreviations

SDD, standard decontamination of the digestive tract.

Competing interests

The author declares that he has no competing interests.

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