Letter

Mild induced hypothermia after out-of-hospital cardiac arrest: persisting doubts about patient safety

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In a study of the endovascular cooling system Alsius CoolGard™ combined with the Icy™ venous catheter, Pichon and colleagues concluded the effectiveness and safety of mild induced hypothermia (MIH) after out-of-hospital cardiac arrest resuscitation [1]. We are troubled because the study has reproduced several safety concerns about MIH that have not been confronted.

First, the sixfold increase of the nosocomial bloodstream infection rate (13% versus control 2%) is most probably related to insertion of endovascular catheters for MIH [1]. Bloodstream infection in patients with endovascular catheters can become a significant cause of preventable morbidity and mortality [2].

Second, it is unclear why hypokalemia (75% of MIH cases) was dismissed as a factor for the incidence of cardiac dysrhythmia [1]. Temperature changes induce electrolyte shifts and thus influence the depolarization and repolarization times and the conduction velocity of action potentials within the myocardium, promoting aberrant conduction pathways. Electrolyte abnormalities associated with MIH can influence electrophysiological parameters of the myocardium, triggering dysrhythmia [3].

Third, it can be argued that MIH may have contributed to refractory cardiogenic shock and early death. MIH blunts the myocardial response to inotropic medications and increases the requirement for vasopressors to maintain hemodynamic stability [4]. The survival benefit for out-of-hospital cardiac arrest from an early intervention for coronary reperfusion and restoration of optimal cardiac performance substantially exceeds the survival benefit from MIH [5].

Fourth, MIH can prolong and augment the activation of inflammatory cytokines [6]; manifesting with rebound hyperthermia upon re-warming (74% of MIH cases) [1]. The cytokine response to MIH can diminish the favorable neuroprotective effect, and can perhaps exacerbate acute organ injury.

Fifth, the concurrent use of muscle relaxants in MIH may conceal clinical signs of epileptic activity after cardiopulmonary resuscitation and hypoxic insult to the brain. Continuous monitoring of the electroencephalogram is necessary to detect and treat provoked epileptic activity, otherwise secondary neuronal injury can progress during MIH [7]. Immediate neurophysiologic studies after cardiopulmonary resuscitation suggest that MIH has a limited therapeutic benefit for neurologic salvage or protection [8].

It is imperative to recognize that MIH as a treatment modality after cardiopulmonary resuscitation has a narrow safety margin, and its misapplication can lead to unintended deleterious consequences [9]. Pichon and colleagues highlight several safety concerns that must be addressed before recommending the broad application of endovascular cooling devices in clinical practice.

Authors' response

Nicolas Pichon and Bruno François

We assent to the potential relationship between the development of nosocomial bloodstream infection and MIH, and future specific studies may provide clarity about this relationship. Moreover, we agree that hypothermia probably

MIH = mild induced hypothermia.

induces electrolyte shifts, but the literature demonstrates that the influence of electrolyte disorders on potential dysrythmia and the risk of arrhythmias increase significantly when the temperature drops below 30°C, which is not the case in our study [10,11]. Concerning the cardiogenic shocks, MIH may have contributed to worsening hemodynamics and therefore should not be induced in these patients until further data are available. Two studies, however, have demonstrated that MIH seems beneficial in these conditions [4,12]. The endovascular cooling system does not exclude an early intervention for coronary reperfusion, and the association of MIH and coronary reperfusion may increase the survival rate [12].

The 'rebound hyperthermia' frequently observed after rewarming may decrease the beneficial effects of MIH on brain injury and has not yet been clearly explained [10]. An additional use of the cooling system (target temperature of 37°C for several hours) after rewarming appears an efficient technique to avoid 'rebound hyperthermia' and the activation of inflammatory cytokines, but deserves further study (unpublished data).

Hypothermia alone significantly reduces the number of and the severity of motor seizures, and exhibits anticonvulsant effects in addition to the large use of benzodiazepines for sedation [13].

Even if several safety concerns remain to be investigated, none of the adverse effects result in a worsened outcome. In addition, the beneficial effect of the endovascular cooling system by far exceeds the complications.

Competing interests

The authors declare that they have no competing interests.

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