Management of cardiac arrest patients in the ICU: is keeping a cool head the standard of care?

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Out-of-hospital cardiac arrest (OHCA) presents a significant challenge to modern acute care medicine. In the United States, OHCA is responsible for 225 00 deaths per year, representing up to 50% of the mortality associated with cardiovascular disease.[1] The condition is associated with high case mortality and potential for permanent neurological impairment in survivors. In the period before therapeutic hypothermia, clinical signs and electrophysiological criteria were developed to predict patient outcome relatively early in the course of the intensive care unit stay.[2]

In 2002, the *New England Journal of Medicine* simultaneously published reports from Australia[3] and Europe[4] of improved survival and neurological outcome in patients with OHCA with an initial rhythm of ventricular fibrillation. The Hypothermia After Cardiac Arrest Study Group conducted a multicentre trial that enrolled 275 patients, and reported that patients in the hypothermia group (target temperature, 32°–34° C) were more likely to have a favourable outcome and had lower 6-month mortality.[4] Similarly, in a multicentre study of 77 patients, Bernard and colleagues reported that therapeutic hypothermia resulted in marked improvement in numbers who survived and who were discharged home or to a rehabilitation facility.[3] In comparison with modern critical-care trials, these studies were small. However, both found differences between the control and intervention arms that were significant — statistically and clinically.

In this issue of the Journal (*page 97*), Whitfield and colleagues report a study of the application and potential effects of therapeutic hypothermia in a cohort of 142 patients admitted to their ICU with OHCA over a 7-year period.[5] In this study, the therapy was applied in the context of usual care, in the absence of the highly monitored environment of a randomised trial or a potentially interested protagonist of the therapy.

In 123 patients with OHCA presumed secondary to a cardiac event, 95 had an initial ventricular arrhythmia, and 60 received therapeutic cooling. The study design involved retrospective data collection and a before-and-after comparison. This design has the inherent limitations of non-randomised allocation to the intervention, with the potential for differences in baseline patient covariates, or changes in outcome with time caused by other interventions.[6] Despite these limitations, the patients in each arm displayed similar baseline characteristics. In addition, the outcome measures were robust, could not be influenced by the investigators, and were similar to those previously published.[3] Interestingly, the differences in mortality rate between the two patient cohorts were similar in magnitude to those reported in the two previously published randomised trials (Table 1).

Table 1. Outcomes in studies of therapeutic hypothermia for out-of-hospital cardiac arrest

	Hypothermia Study Group[4]*	Bernard et al[3]†	Whitfield et al[5]†
Number of patients	275	77	95‡
Control survival	45%	26%	31%
Hypothermia survival	59%	49%	57%

* Hypothermia After Cardiac Arrest Study Group: 6-month survival.
† Survival to hospital discharge and discharge home or to a rehabilitation facility.
‡ Subset of patients with ventricular fibrillation or unstable ventricular tachycardia from a total group of 123.

The study by Whitfield et al demonstrates the difficulties associated with achieving rapid therapeutic hypothermia. It also found that patients subjected to the treatment had longer stays in hospital and in the intensive care unit.

What can be concluded from these collective studies, and what recommendations can be made for the application of therapeutic hypothermia to comatosed initial survivors of OHCA?

Therapeutic hypothermia has been advocated as a treatment for OHCA with an initial rhythm of ventricular fibrillation or ventricular tachycardia by the International Liaison Committee on Resuscitation.[7] Bernard suggested that it should be a standard of care.[8] Deleterious effects of the therapy can include increased risk of infection,[4] lowered cardiac index,[3] and induction of a bleeding diathesis. Despite these risks, the available evidence suggests that overall the therapy appears to improve the overall outcome of OHCA. It is likely that the application of sedation and therapeutic hypothermia will prolong length of stay, particularly in the ICU. As clearance of sedation may be impaired in hypothermia,[8] the combined effects of sedation and hypothermia are likely to affect neurological assessment of the recovering comatose patient.

In the absence of additional information, it appears that intensive care physicians should keep a "cool head" when treating initial survivors of OHCA. Additional research is

required to assess the effectiveness of this therapy for OHCA not caused by ventricular fibrillation or ventricular tachycardia, and the most effective method to achieve rapid hypothermia, and also to reassess predictors of prognosis in the era of hypothermia.

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