Steeplechase in Emergency Medical Care
Cooling for Cardiac Arrest

Derk W. Krieger, MD, PhD

The great majority of patients who experience cardiac arrests expire after the event. Moreover, full neurological recovery occurs in only a small proportion of the survivors. Until recently no specific postarrest therapy was available to improve that outcome. Therapeutic cooling (32°C to 34°C for 12 to 24 hours) applied after cardiac arrest has been shown to improve this dismal situation. In 2002, two randomized clinical trials of mild therapeutic hypothermia applied to unconscious patients after successful resuscitation from cardiac arrest revealed that therapeutic cooling is capable of improving neurological outcome while reducing mortality.1,2 Both studies focused on an out-of-hospital population with ventricular-fibrillatory cardiac arrest and brief intervals to return of spontaneous circulation but remained comatose. These patients are considered the “sweetspot” population for a neuroprotective trial for this condition.

Current International Liaison Committee on Resuscitation (ILCOR) guidelines reflect those inclusion criteria recommending that unconscious adult patients with spontaneous circulation after out-of-hospital cardiac arrest should be cooled to 32°C to 34°C for 12 to 24 hours when their initial rhythm was ventricular fibrillation. These recommendations also suggest that such cooling may also be beneficial for other rhythms or in-hospital cardiac arrest.3

There are several possible mechanisms by which mild hypothermia could improve neurological outcome when used after reperfusion. In normal brain, hypothermia has shown to reduce the cerebral metabolic rate for oxygen (CMRO2) by 6% for every 1°C reduction in brain temperature above 28°C. Although slowing metabolism may defend against brain injury in circulatory arrest, it is unlikely to explain aided recovery after reperfusion. Thus, hypothermia may suppress a variety of chemical reactions associated with reperfusion injury, such as free-radical production, excitatory amino acid release, and calcium shifts, which in turn may cause mitochondrial injury and apoptosis. On the flip side, therapeutic cooling is known to cause adverse effects, including arrhythmias, infection, and coagulopathy.

The introduction of therapeutic cooling after cardiac arrest into routine intensive care algorithms could enhance the lives of thousands of survivors, because only 6 patients need to be treated to yield 1 additional favorable neurological recovery. The optimal duration, depth of hypothermia and rewarming pace are currently unknown. Innovative cooling techniques to simplify its use and integration with other treatments to enhance its efficacy are currently under investigation. Although it is very difficult to make the case for additional placebo-controlled trials, studies addressing refinements in cooling technology or treatment algorithms are welcomed.

The study by Holzer et al4 illustrates very elegantly how this can be accomplished. The authors attempted to depict the impact of a novel cooling technique for cardiac arrest patients. Using an institutional database they performed a retrospective Bayesian analysis of endovascular cooling versus normothermic controls applying a rather conservative estimate on the benefit of the cooling therapy.

In the endovascular cooling group, 51 of 97 patients survived with favorable neurology as compared with 320 of 941 in the control group (odds ratio 2.15, 95% CI, 1.38 to 3.35; P=0.0003; adjusted odds ratio 2.56, 1.57 to 4.17). There was no difference in the rate of complications except for bradycardia. For comparison, a pooled analysis of the previous controlled studies1,2,5 revealed a favorable neurological outcome in 96 of 195 patients as opposed to only 59 patients of 188 controls (odds ratio, 1.68; 95% CI, 1.29 to 2.07).

Additional registries at different institutions and countries are needed to confirm the added benefit of various alterations to the basic ILCOR recommended cooling protocol for comatose patients after cardiac arrest.

In spite of ILCOR recommendations, therapeutic cooling remains underused for this indication at most institutions. This resistance is conspicuous and measures up to the opposition that cropped up in the wake of thrombolysis for acute ischemic stroke. A recent internet-based survey revealed that 95% of emergency physicians and 89% of cardiologists had never used therapeutic cooling. Of all respondents, roughly 50% quoted insufficient data while 20% considered it too technically difficult.

Although most of the debate concerns feasibility and efficacy of the cooling intervention, the real motive may simply be reluctance to deviate from traditional established pathways and logistics. In the light of the impressive results without any added risk, we need to move beyond these habits and devise new pathways to accommodate this therapy. As demanded by Peter Safar over 40 years ago, therapeutic cooling must take priority for the moment following return of spontaneous circulation after cardiac arrest.6 Holzer’s study along with all the previous trials are evidence enough that cooling must be commenced in the field, accomplished in the emergency room and integrated with other treatments in the intensive care unit. Key involvement of professional organi-

DOI: 10.1161/01.STR.0000227244.54383.75
zations and patient-interest groups is crucial to recognize therapeutic cooling as ongoing resuscitation and support its use.

**Disclosure**

Dr Krieger has been a consultant for Medcool Inc, Waltham MA and has received lecture fees and honoraria from Boston Scientific Corporation, Needham MA, McNeil Pharmaceuticals, Philadelphia PA and Radiant Medical, Redwood City CA in the past.

**References**


**Key Words:** cardiac arrest, critical care, hypothermia
Steeplechase in Emergency Medical Care: Cooling for Cardiac Arrest
Derk W. Krieger

Stroke. 2006;37:1638-1639; originally published online June 8, 2006;
doi: 10.1161/01.STR.0000227244.54383.75
Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2006 American Heart Association, Inc. All rights reserved.
Print ISSN: 0039-2499. Online ISSN: 1524-4628

The online version of this article, along with updated information and services, is located on the
World Wide Web at:
http://stroke.ahajournals.org/content/37/7/1638

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published
in Stroke can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office.
Once the online version of the published article for which permission is being requested is located, click
Request Permissions in the middle column of the Web page under Services. Further information about this
process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Stroke is online at:
http://stroke.ahajournals.org//subscriptions/