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EDITORIAL COMMENT

The Need for Both Therapeutic Hypothermia and Early Coronary Angiography After Out-of-Hospital Cardiac Arrest*

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Sudden, unexpected, out-of-hospital cardiac arrest is a major public health problem resulting in the death of >350,000 adults in the United States each year (1), exceeding the number of deaths from all other entities, except overall cancer deaths (2). The median survival to hospital discharge rate with any first recorded cardiac arrest rhythm is 12% when emergency medical services personnel attempt resuscitation. However, because emergency medical services personnel attempt resuscitation in only one-half of all cases (the remainder are unwitnessed events in which the victim is found deceased), the overall national survival rate from out-of-hospital cardiac arrest is actually only 6.3% (1). Based on these alarming statistics, we need to optimize every patient's odds for survival by following the American Heart Association (AHA), American College of Cardiology (ACC), and European Society of Cardiology guideline recommendations to use therapeutic hypothermia plus an early invasive strategy without fear of interventionalists being penalized by public reporting of their overall percutaneous coronary intervention (PCI) mortality (3,4).

Therapeutic hypothermia applied to patients with an initial shockable rhythm resuscitated successfully from out-of-hospital cardiac arrest is of proven benefit and has an AHA Class I recommendation (5). It is also recommended (AHA Class I) for use in cases without an initially shockable rhythm (5). Although randomized clinical trial data do not yet exist (2 are in progress [6]), the AHA/ACC/European Society of Cardiology practice guidelines also recommend (Class I) immediate coronary angiography for post-arrest patients with or without ST-segment elevation on their initial electrocardiogram (ECG) and who do not have another clear, noncardiac cause for their arrest (3,4,6). This recommendation stands whether the patient is comatose or awake, because neurological prognostication is inaccurate for ≥72 h after the event (6).

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In this issue of *JACC: Cardiovascular Interventions*, Kern et al. (7) provide additional experimental information on the use of therapeutic hypothermia combined with a strategy of early coronary reperfusion. Ventricular fibrillation was induced electrically in 32 anesthetized adult swine after acute occlusion of the left anterior descending coronary artery with an intracoronary balloon. Cardiopulmonary resuscitation was started after 4 min, and defibrillation was attempted 2 min later. After return of spontaneous circulation, animals were randomized to 4 treatment groups: A) hypothermia to 34°C plus reperfusion (left anterior descending balloon deflation after 45 min); B) hypothermia plus no reperfusion; C) no hypothermia plus reperfusion; and D) no hypothermia and no reperfusion. The primary endpoint was infarct size at 4 h quantified by planimetric calculation of myocardial tissue slices stained with Evans blue dye and tetrazolium chloride. Group A animals treated with both hypothermia and early reperfusion had the smallest infarct size. Animals treated with hypothermia without early reperfusion (group B) or neither hypothermia or early reperfusion (group D) had the

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largest infarct size. Animals treated with early reperfusion alone (group C) had intermediate-sized infarcts.

These results add strong experimental support to the growing body of evidence supporting a combination strategy of hypothermia plus an early invasive management (3,4,6). However, the current use of an early invasive strategy for these patients is greatly variable and somewhat controversial (6) in the United States, despite case series and cardiac arrest registries showing consistently increased survival to hospital discharge with improved neurological outcomes when such procedures are performed soon after hospital arrival (3,4,6). For example, Vyas et al. (8) conducted a propensity-matched analysis on the largest case series (n = 4,029) of out-of-hospital cardiac arrest patients resuscitated from an initial rhythm of ventricular fibrillation or pulseless ventricular tachycardia admitted to 374 hospitals in the United States. Fewer than one-half (48.5%) of the patients underwent early coronary angiography as directed by their attending cardiologist's preference. Early coronary angiography was associated with a 52% improvement in survival to hospital discharge and a 47% improvement in the number of survivors with a favorable neurological outcome.

So why are fewer than one-half of these patients going to the cardiac catheterization laboratory early after hospital arrival (8)? Public reporting of PCI outcome statistics that include out-of-hospital cardiac arrest patients is a major factor. Peberdy et al. (9) documented the negative impact of public PCI performance reporting on the use of early coronary angiography and PCI after cardiac arrest in an official AHA Scientific Statement. Because the mortality rate due to the disease is roughly 10 times greater in an out-of-hospital cardiac arrest patient with an ST-segment elevation myocardial infarction (STEMI) going to the cardiac catheterization laboratory compared with a STEMI patient without a prior cardiac arrest, lumping the PCI outcomes of the cardiac arrest patients with the nonarrest STEMI patients has a catastrophic impact on the public reporting of outcomes; there is inadequate, or nonexistent, risk adjustment for inclusion of the cardiac arrest cases in virtually all current reporting registries. The AHA Scientific Statement (9) also outlines in detail why appropriate risk adjustment for these patients is not possible.

A recent strong statement by the Interventional Council and the Board of Governors of the ACC endorsed the AHA recommendations for public reporting entities to track, but not publicly report, outcomes of out-of-hospital cardiac arrest patients who are taken directly to the cardiac catheterization laboratory soon after hospital arrival (10). Their position reinforces the results of a recent national survey conducted by the Interventional Council of the ACC showing interventionalists have serious concerns regarding the current National Cardiovascular Data Registry risk-adjustment methodology (10). Of 1,297 responses, 86% did not want public reporting of mortality rates after PCI in cardiac arrest patients.

Should we be taking just cardiac arrest patients with an acute STEMI on the ECG, or all cardiac arrest patients (barring other considerations such as terminal illness, patient or family wishes, and so on), to the cardiac catheterization laboratory soon after hospital arrival? Absence of ST-segment elevation on the initial postresuscitation ECG does not accurately identify who should undergo immediate coronary angiography (6,11), even though almost two-thirds of surviving out-of-hospital cardiac arrest victims have an acute culprit lesion when immediate coronary angiography or coronary computed tomographic imaging is performed (12). Staer-Jensen et al. (11) performed immediate coronary angiography on 210 consecutive out-of-hospital cardiac arrest patients without a clear noncardiac cause and found that 1 out of every 7 resuscitated patients without ST-segment elevation had an acutely occluded coronary artery. They concluded that lack of ST-segment elevation on the initial postresuscitation ECG should not be used as a reason to avoid early coronary angiography, an opinion echoed in the ACC/AHA/European Society of Cardiology Guidelines (3,4).

Mounting evidence firmly supports a more aggressive, early interventional approach added to therapeutic hypothermia for the majority of adult patients who have been resuscitated successfully after out-of-hospital cardiac arrest. The goal of publicly reported performance measures should be to improve medical care, not stand in its way. Interventionalists should not continue to be placed in the ethical dilemma of doing what is right for the patient at the expense of publicly reported PCI performance measures that include out-of-hospital cardiac arrest patients brought immediately to the catheterization laboratory. Given that it has been more than 3 years since the AHA officially brought this issue to national attention, it is time for national and state organizations responsible for public reporting of PCI quality metric entities to remove this unjustifiable barrier to patient care.

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