The current guidelines for the management of out-of-hospital cardiac arrest (OHCA) suggest performing 12-lead electrocardiography immediately after return of spontaneous circulation (ROSC) and initial stabilization have occurred. This is predicated on the finding that early ST elevation on electrocardiography, particularly in the context of a shockable rhythm, is likely to indicate significant obstructive coronary artery disease that may represent the cause of the index cardiac arrest. Multiple prior investigations have shown that electrocardiograms obtained soon after ROSC may reflect ST elevation in the absence of significant epicardial stenoses. This has been postulated to be because of a combination of the profound metabolic insults induced by the index OHCA. Moreover, the myocardial ischemia and stunning caused by repetitive defibrillation and epinephrine administration to treat the index OHCA may further this insult. Similarly, prior observational data has shown that there is an inconsistent association with the existence of significant epicardial coronary artery disease among patients without ST elevation on the early electrocardiogram after ROSC. Given the variable association of early post-ROSC electrocardiograms with critical coronary artery stenoses, it is unsurprising that there is significant heterogeneity in the performance of coronary angiography based on these electrocardiograms. To this end, the authors of the Post-ROSC Electrocardiogram After Cardiac Arrest (PEACE) study attempt to evaluate several factors that underlie the tenuous association of electrocardiographic findings with underlying coronary artery disease.

In this issue of JAMA Network Open, Baldi et al evaluate the association of the timing of electrocardiography after ROSC with false-positive electrocardiograms for ST-elevation myocardial infarction. In their retrospective cohort study, false-positive electrocardiograms were defined as those belonging to patients who exhibited ST elevation on the first electrocardiogram after ROSC but did not exhibit a need for percutaneous coronary intervention on immediate coronary angiography. In multivariate analyses, the authors found that a greater time between ROSC and electrocardiogram after OHCA was associated with lower odds of false-positive electrocardiograms for ST elevation. There were important selection biases that limited the generalizability of the authors’ results. Most notably, approximately 25% of patients who underwent coronary angiography during the study period did so without a post-ROSC electrocardiogram. Additionally, more than half of patients without ST elevation on their initial electrocardiograms progressed to coronary angiography and revascularization, implying a high false-negative rate. However, the authors challenge important dogmas in resuscitation science and provide important food for thought via the PEACE study.

The article by Baldi et al appears at a timely juncture, when there are many dilemmas in the management of patients resuscitated after OHCA. Multiple recent investigations have explored the role of early electrocardiography after ROSC, the importance of early coronary angiography after OHCA, and the benefit of early revascularization in cardiogenic shock and OHCA. These are all clearly important questions that warrant close consideration. However, we believe that the goal of all of these intertwined strategies ultimately speaks to an obvious and possibly more impactful concept—that the key to improving outcomes in OHCA is to prevent the propagation of shock and systemic metabolic derangement that OHCA causes.

The concept of increasing metabolic derangement during and after OHCA is pertinent to various facets of postresuscitation care. In the context of the PEACE study’s findings, the vast metabolic, electrolyte, and electromechanical abnormalities that emerge during OHCA and likely persist after ROSC may cause a greater number of false-positives and false-negatives on early electrocardiography. It is possible that delaying electrocardiography after ROSC, as was done in the...
The PEACE trial, would allow for some normalization of this disruption and improve the reliability of electrocardiography. Beyond the PEACE study, other evidence adjacent to the topic of electrocardiography has clearly delineated the benefit of mitigating metabolic derangement soon after OHCA. For example, this may allow us to reconcile why patients exhibiting cardiogenic shock after OHCA have greater benefit from early coronary angiography and revascularization than those without shock.2 Similarly, the rapid mitigation of metabolic dysfunction with extracorporeal cardiopulmonary resuscitation (CPR) usage may also explain its utility as an important strategy for cardiac arrest.2,4-6 The recently published ARREST trial7 showed a significant increase in survival to hospital discharge and 6-month survival with favorable neurological function with early extracorporeal membrane oxygenation (ECMO)–facilitated resuscitation. As such, it is possible that a unified approach of early access to the cardiac catheterization laboratory with an available ECMO lifeline to be deployed when necessary could mitigate the need for accurate electrocardiogram diagnosis in areas where resources are available.7

We further propose that systematically targeting the specific metabolic, electrolyte, and electromechanical pathways that are impacted during OHCA and the resuscitation process may limit the inaccuracies associated with electrocardiograms soon after ROSC. Importantly, this may concomitantly improve OHCA outcomes. There are several pathways that are ripe for future investigation here. Naturally, a top priority would be to find more effective ways to measure the quality of CPR and the degree of metabolic derangement during resuscitation and immediately after ROSC. This may provide insights into the reliability of early electrocardiographic rhythms. There must also be a concomitant focus on limiting the metabolic derangement from the index OHCA. The most obvious of these steps is to ensure early, high-quality CPR and early defibrillation to maintain adequate coronary and visceral perfusion. While this notion is hardly novel in the field of resuscitation science, the addition of routine mechanical CPR and impedance-threshold devices may further improve the quality of CPR on a population level.4 The addition of novel agents early after ROSC may also permit cardiomyocyte membrane stabilization and prevent the electrical derangement that is thought to lead to false-positive and false-negative electrocardiograms.8

Reorganizing the public health infrastructure to promote the transfer of patients to expert cardiac arrest hubs, where the rapid institution of advanced hemodynamic strategies (such as veno-arterial ECMO) can be sought, may also warrant close consideration.6

In summary, the findings of the PEACE study3 are thought provoking and present a novel avenue for further research. The authors propose a practical way to limit the uncertainty associated with the interpretation of electrocardiograms soon after ROSC. However, in our minds, the PEACE study3 points to even larger questions that underlie the uncertainty associated with interpreting electrocardiograms after ROSC—how do we understand, measure, and limit the metabolic derangement associated with OHCA? To that end, we eagerly look forward to future data evaluating these questions in the context of the PEACE study’s findings.

**ARTICLE INFORMATION**


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