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The Journal of Critical Care Medicine 2016;2(1):3-5 **EDITORIAL**

DOI: 10.1515/jccm-2016-0007

Out-of-Hospital Cardiac Arrest in Acute Myocardial Infarction and STEMI Networks

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Out-of-hospital cardiac arrest (OHCA) remains associated with a poor prognosis, with a survival rate of approximately 10% [1]. Only 40% of patients presenting with OHCA are successfully resuscitated, and only 25% of them survive to hospital discharge [1].

In many cases of OHCA associated with acute myocardial infarction, the cardiac arrest is caused by ventricular fibrillation, occurring during the first hours after the onset of symptoms, and before the patient being admitted to hospital [2]. In these critical cases, implementation of specific protocols and dedicated networks are crucial for providing effective advanced cardiac life support.

Several treatment modalities have been proposed to improve outcomes in the post-resuscitation period. One such measure is induced therapeutic hypothermia, consisting of administering cooling infusions to cool the patient down to 32-34^{0}C, and maintaining this for 12-24 hours. Evidence shows that when initiated promptly, cooling improves neurological outcomes in survivors of OHCA [3,4]. However, there is no clear evidence that hypothermia would lead to a significant reduction in mortality in these patients. Current guidelines recommend early therapeutic hypothermia as a class Ib indication, in the post-resuscitation phase, after cardiac arrest in patients who are comatose or deeply sedated [2].

Another measure, with a high potential to improve outcomes in the post-resuscitation phase, is percutaneous coronary intervention following coronary angiography. Several studies have shown that over 70% of patients who suffered an OHCA had significant coronary artery disease, and almost 50% of them had a completely occluded coronary artery [5]. Evidence shows that most OHCA cases have a cardiac aetiology, and the cardiac arrest was triggered by an acute coronary event [1].

In patients with an OHCA and ST-segment elevation, guidelines recommend immediate angiography, as the procedure of choice, especially in patients suspected of having ongoing ischemia, on the basis of various signs such as the presence of chest pain before the cardiac arrest [2]. In these cases, the time interval between the onset of symptoms to revascularization should be less than 12 hours, in line with the limits stated in the current guidelines for management of ST-segment elevation myocardial infarction (STEMI) [6].

European guidelines indicate immediate angiography and primary revascularization in all patients with resuscitated cardiac arrest and ST-segment elevation on ECG, and also in patients with resuscitated cardiac arrest without ST-segment elevation, but with high probability of an ongoing infarction (indication Class Ib) [2].

Taking into consideration the high probability of an acute coronary event as the cause of the cardiac arrest, coronary angiography is currently indicated in all survivors of OHCA, in the absence of an obvious non-cardiac aetiology of the cardiac arrest [7]. The Parisian Region Out-of-Hospital Cardiac Arrest (PROCAT) registry reported that a significant coronary lesion, considered as the culprit lesion, was present in 58% of patients with OHCA without ST-segment elevation on ECG. It was confirmed that urgent PCI was a reliable predictor of a good outcome, independent of the presence of ST-segment elevation on ECG, suggesting that immediate coronary angiography and

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PCI should be performed in all cases of OHCA which have no obvious non-cardiac aetiology [8].

A study by Barcan et al., published in this number of the JCCM [9], identifies the presence of cardiogenic shock, multivessel disease, renal failure, anaemia, the need for mechanical ventilation for more than 48 hours, and a duration of stay in the ICU longer than five days, as the most significant independent predictors of mortality in patients with OHCA and STEMI. However, the study does not include any data on patients with OAHC without ST-segment elevation on ECG, patients in which identification of the aetiology of cardiac arrest and, therefore, therapeutic decisions, are much more difficult than in patients with STEMI.

In acute coronary syndromes, the time from the onset of symptoms to revascularization is critical for survival. It has been demonstrated that in STEMI patients, the relative risk of death was 1.08 for every additional 30 minutes delay in providing revascularization therapy [10]. However, while in STEMI, survival is directly depending on the duration from the onset of symptoms to revascularization, non-STEMI patients did not show any significant improvement in survival when the coronary intervention was performed within the first twelve hours from the onset of symptoms [11].

This group of patients with non-STEMI is unlikely to benefit from early initiation of a revascularization procedure [12]. A meta-analysis of seven trials and four observational studies, reporting on more than 80.000 non-STEMI patients, showed no significant benefit for death, myocardial infarction or major bleeding, when performing coronary revascularization before 24 hours, compared to a delayed invasive strategy, carried out after a 24 hours delay [13].

However, it is well-known that current recommendations are based on a high number of large-population randomized trials that excluded OHCAs, probably due to the concern over poorer outcomes [1].

An important finding of the study published by Barcan et al. in this number [9] was that the time from the onset of the cardiac arrest to revascularization, referred to as "arrest-to-balloon time", was significantly correlated with survival after OHCA. Not surprisingly, the authors found a significantly lower "arrest-to-balloon time" in patients who survived after OHCA and were discharged compared to those who died during hospitalization (67.0 +/- 44.4 minutes compared to 103.0 +/- 56.34 minutes, p=0.002). This observation underlines the importance of delivering healthcare expeditiously to patients with acute coronary events.

In agreement with other studies that evidentiated the role the role of a well-organized STEMI network in reducing critical time intervals and improving survival in STEMI populations [13,14], this study indicates the need for the proper organization of STEMI networks, enabling patients to be admitted to the catheterization unit timeously, and for the optimally management of critically ill patients suffering cardiac arrest at home.

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