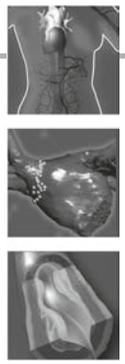

Patients with resuscitated sudden cardiac arrest: forgotten 'orphans' of interventional cardiology?

"It was the introduction of mild induced hypothermia in 2002 that undoubtedly revolutionized the field of postresuscitation treatment of comatose survivors..."

KEYWORDS: cardiac arrest ■ coronary angiography ■ hypothermia ■ percutaneous coronary intervention

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Sudden cardiac arrest remains the leading cause of death in developed countries, with an annual incidence ranging from 36 to 81 events per 100,000 inhabitants. Following initial cardiocerebral resuscitation, re-establishment of spontaneous circulation (ROSC) is achieved in 40–60% of patients who are subsequently transported to our emergency departments. Because of typical delays in the 'chain of survival', up to 80% of patients remain unconscious despite ROSC, and constitute a subgroup of comatose survivors of cardiac arrest. Coma despite ROSC pinpoints to postresuscitation brain injury with its severity ultimately varying from mild disability to permanent vegetative state and can not be accurately prognosticated on hospital admission. Only a minority of 'lucky losers' with prompt initiation of chest compression and defibrillation, which is usually the case if emergency medical personnel are already present at the scene of cardiac arrest, regain consciousness immediately after ROSC, and they constitute a subgroup of conscious survivors of cardiac arrest. Return of consciousness immediately after ROSC, in contrary to coma, indicates absence of significant postresuscitation brain injury. If acute coronary event is suspected, conscious survivors of cardiac arrest routinely undergo immediate coronary angiography and revascularization, as with acute coronary syndrome (ACS) patients, without cardiac arrest and have excellent prognosis [1]. Indeed, there has never been a big controversy regarding utilization of urgent interventional strategies in these patients, despite the fact that they were mainly excluded from major interventional ACS trials. On the other hand, since no effective treatment was available for postresuscitation brain injury in the past, comatose survivors of cardiac arrest have never triggered much interest within the interventional community because they typically died in the hospital or nursing homes without regaining consciousness. Treating coronaries if a patient does not wake up from coma is indeed a futile and meaningless act. It was the introduction of mild induced hypothermia in 2002 that undoubtedly revolutionized the field of postresuscitation treatment of comatose survivors [2,3]. Since comatose survivors of cardiac arrest undergoing hypothermia started to 'wake up' in our cardiac intensive care units in the days following admission, more efforts have been made to define and treat the cause of cardiac arrest. We have therefore realized, what has been know for several years, that obstructive coronary artery disease is present in the majority of patients and that an acute coronary event is usually the main trigger of sudden cardiac arrest [4].

Karl Kern has provided an excellent review of the topic and presented accumulating clinical research on this field [5]. We have learned that urgent coronary angiography is feasible and safe, and leads to diagnosis of presumed acute culprit lesion in the majority of patients with ST-elevation myocardial infarction (STEMI) and in 25–58% of patients with other patterns in early postresuscitation ECG [4,6–8]. Importantly, the finding of normal coronary arteries or nonobstructive coronary disease is very useful because it triggers a search for alternative causes of cardiac arrest. However, immediate coronary angiography is followed by, what we call in our hospital, cardiac arrest percutaneous coronary intervention (CA-PCI) in a great majority of STEMI patients and in a significant proportion of patients without obvious STEMI in early postresuscitation ECG. The rationale is that successful CA-PCI of acute culprit lesion will decrease incidence of reccurent malignant arrhythmias and improve cardiac function by reducing size of myocardial infarction. CA-PCI

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is therefore primarily directed towards lesions with the same angiographic appearance routinely observed and treated in ACS patients without cardiac arrest. CA-PCI of obvious obstructive but not necessarily acute lesions may also be beneficial in hemodynamically unstable patients, including those with postresuscitaton cardiogenic shock being present much more often than in the ACS population without cardiac arrest. Again, we extrapolated the knowledge from acute coronary patients with cardiogenic shock but without preceding cardiac arrest to an even sicker population after resuscitated cardiac arrest [9]. The good news regarding CA-PCI is that angiographic success is comparable to PCI in ACS without cardiac arrest and is not likely to be compromised by ongoing hypothermia [10,11]. Because of the significant proportion of patients with hemodynamic instability after ROSC, hemodynamic support with intra-aortic balloon counterpulsation and even with more effective assist devices is becoming increasingly used if short-term delays and effective resuscitation argue for good neurological recovery. With successful CA-PCI and hemodynamic stabilization of a comatose survivor of cardiac arrest, we can 'buy' precious time for completion of 24-h hypothermia and possible neurological recovery during subsequent days. Indeed, as Karl Kern indicated, 80–90% of comatose patients after resuscitated cardiac arrest who survive long-term, achieve favorable neurological recovery. This is in striking contrast with the 'prehypothermia era', where the majority of survivors remained in a permanent vegetative state.

Despite the impressive benefits of invasive coronary strategies coupled with hypothermia, many interventional cardiologists still wait for randomized trials with the rationale that immediate interventional strategies may only change the pattern of dying of comatose survivors of cardiac arrest. Instead of dying with an occluded major epicardial vessel due to reccurent cardiac arrest or cardiogenic shock within a few days, the patient will die later in permanent vegetative state. Will we ever get randomized trials to unequivocally answer this dilemma? Are such trials, in view of the data summarized by Karl Kern, still ethical? We have very consistent, independent studies of consecutive allcomers showing doubled survival between 50 and 60%, with the majority of patients leaving hospital with good neurological recovery after introduction of immediate coronary angiography, CA-PCI and hypothermia protocols [12–15]. Would you randomize a comatose survivor of cardiac arrest with large anterior STEMI to conservative treatment? The majority of interventionalists I spoke with would not because they feel it is unethical. Are we then left only with randomization of comatose patients without obvious STEMI in postresuscitation ECG and absence of obvious noncoronary cause? Maybe. However, if we ever conduct such an interventional study it needs to be performed only in '24–7' interventional centers with a well functioning hypothermia program.

Should we, as the interventional community, continue to undertreat comatose survivors of cardiac arrest and wait for randomized trials? No, I think we should use logical extrapolation of numerous randomized interventional studies in ACS and cardiogenic shock from patients without cardiac arrest and couple them with hypothermia as claimed by Karl Kern. This is, in my opinion, just a logical application of two strongly evidence-based strategies to one of the sickest population in cardiovascular medicine. We should therefore go ahead and 'upgrade' our '24–7' primary PCI network by adding 'hypothermia-CA-PCI' fast track for comatose survivors of cardiac arrest. Indeed, an increasing number of hospitals have already designed such postresuscitation protocols [12–15] and their results should be a 'wake-up call' for interventional cardiologists to become an essential part of postresuscitation team. In contrast to elective PCI where we continue to compete and occasionally loose the battle with cardiac surgeons [16], urgent PCI is clearly a life-saving intervention that can be offered only by us. And those of us who believe and do it, should not be punished by the public reporting of outcome data because we get up in the middle of the night and give a 50–60% chance to a comatose survivor of cardiac arrest. For me it is logical that interventional outcome data should be reported separately for elective PCI, ACS-PCI and CA-PCI in comatose survivors of cardiac arrest.

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