

Editorial

Cardiac Arrest Survivors Before They Reach Hospital. Beyond Cardiopulmonary Resuscitation

Supervivientes a parada cardiaca antes de llegar al hospital. Más allá de la reanimación cardiopulmonar

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EVOLUTION OF THE CORONARY CARE UNIT

Since their creation in the 1970s, coronary care units have become established as specialized units for the management of cardiac arrest associated with acute myocardial infarction.¹ The 40% mortality rate common at that time was soon reduced by 50% as a result of the identification and early treatment of ventricular fibrillation.² Over the following 20 years, research in coronary care units tended to concentrate on reducing infarct size and on treating and preventing heart failure, thus reducing mortality by a further 50%. In the current age of percutaneous interventionism, half a century after the introduction of coronary care units, 30-day mortality for patients with acute coronary syndrome and ST segment elevation is less than 0.5% if the patient reaches hospital alive and conscious and does not have heart failure upon admission.³ Indeed, once protocols for the early management of these patients have become established and simplified, most will probably not require admission to these specialized units. In the search for new targets for improvement, coronary care units are slowly turning into critical cardiac care units and have begun to concentrate on clinical situations in cardiology that require complex management or those that still produce a high rate of complications. To comply with the founding philosophy of coronary care units, research in such units should probably concentrate on those processes in which little progress has been made and that still produce high morbidity. Although survivors of out-of-hospital cardiac arrest account for only a small number of hospital admissions, they currently represent a group with some of the highest complications and mortality rates in critical cardiac care units and therefore consume a significant proportion of their available resources.

For the field of critical cardiac care to advance, an essential first step is to understand the current situation. A recent article published in *Revista Española de Cardiología* discusses a joint

initiative by 5 critical cardiac care units in Catalonia⁴ that aimed to identify the characteristics and prognostic factors of survivors of out-of-hospital sudden cardiac arrest in our setting. This initiative is of particular interest in this field and constitutes the basis for obtaining research results sooner than would be possible in single-center experiences. While acknowledging that the conclusions of their study cannot be extrapolated, the authors contrast their promising results with those of other similar studies and suggest that the improved outcomes are probably the result of several factors. Mortality from out-of-hospital sudden cardiac arrest over the past 10 years has been reduced in several autonomous regions of Spain and has been attributed to improvements in prehospital and hospital-based care.⁵ A recent study calculated that two-thirds of this reduction in mortality was probably due to improved out-of-hospital care, with the remaining third being due to improvements in the care received after pulse restoration in the hospital setting.⁵ Consequently, as noted by the authors of that study, schemes to train the general public in bystander cardiac resuscitation, reported as being very scarce in all series, should be encouraged, and these procedures should be demonstrated in schools, workplaces, and at public events, etc. However, health care professionals should also be kept up-to-date on recent progress in resuscitation and guidelines on the topic.⁶ Recent findings indicate that implementing new recommendations in cardiopulmonary resuscitation, especially those relating to minimizing interruptions in chest compressions during resuscitation, would increase the possibility of obtaining good results.⁷

THERAPEUTIC HYPOTHERMIA

Among the in-hospital measures that have improved the prognosis of cardiac arrest, that with the strongest impact on survival has probably been the introduction of therapeutic hypothermia. Indeed, this is the only strategy that has been shown to improve the prognosis of patients who do not regain consciousness once a heartbeat has been restored after cardiac arrest. Surprisingly, more than 10 years after clinical practice guidelines began to recommend its use,⁸ therapeutic hypothermia remains far from widespread; very little progress has been made in

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this field and a great many issues remain to be resolved. One of the main barriers to its more general implementation is that some authors continue to believe that its utility has not yet been demonstrated, because recommendations for the use of this technique are based on studies with major flaws.⁹ A reasonable assumption is that, if hypothermia is useful, the sooner it can be initiated the better the outcome, as is the case with most effective treatments, particularly those for critical patients. Among other possible improvements, initiatives to introduce this treatment in the out-of-hospital setting should be encouraged, with simple methods to minimize delays in its application.¹⁰

Along similar lines, some findings suggest that, although patients should be cooled as soon as possible, the target temperature chosen also affects prognosis.¹¹ Therefore, further research in this field is also vital to determine the optimal target temperature, which may be below currently recommended temperatures. Many issues in hypothermia therefore remain to be resolved, and both the optimal temperature and its recommended duration are currently unknown. Curiously, initial studies recommended maintaining a temperature of between 32°C and 34°C for 12 to 24 h in adults,⁸ whereas for perinatal asphyxia-related encephalopathy, whose pathophysiology of neurological damage is similar to that of the encephalopathy occurring after recovery from a cardiac arrest, temperatures of between 33°C and 34°C for 72 h are recommended on the basis of 2 studies in neonates that showed better neurological outcome.^{12,13} Surprisingly, these hypothermia ranges and duration are not based on studies comparing different times but on verification that this duration and cooling are well tolerated. Likewise, there have been no studies on how patients should be warmed, whether warming should be controlled or not, and whether the hyperthermia that commonly occurs in the context of postcardiac arrest syndrome as a systemic inflammatory response should be avoided, although such avoidance is a common practice.

POSTCARDIAC ARREST SYNDROME

The lack of data on the general management of patients with postcardiac arrest syndrome is perhaps even more marked, especially regarding issues as important as the optimal management of myoclonus and seizures and whether their prophylactic treatment is indicated. It is also of vital importance to determine whether the use of prophylactic antibiotic therapy is of any use and, if so, to determine the most appropriate strategy, as early temperature control masks the possible presence of fever unless difficulties in achieving the target temperature are encountered whilst the temperature is being controlled.

A further area for research is the early and reliable identification of the neurological prognosis of these patients. The hypothermia and multiple organ failure common in these patients slow the metabolism of sedatives and muscle relaxants, which can delay correct neurological evaluation. Similarly, neurological recovery may continue to occur later in patients treated with hypothermia than in those not undergoing this technique.¹⁴ Previously, the appropriate time for neurological evaluation was considered to be 72 h after pulse recovery, but recent findings have shown that patients treated with hypothermia can regain consciousness more than 6 days after pulse recovery.¹⁴ This finding is of vital importance to avoid premature limitation of therapeutic effort in patients who could potentially recover. On the other hand, it is desirable to withdraw unnecessary extraordinary measures that generate false expectations and possibly cause psychological harm to family members and that also increase costs in patients with no hope of recovery. Strategies for neurological prognosis vary widely from group to group,

depending on their access to the various techniques. Continual advances in knowledge are essential because current management is highly heterogeneous. Thus, some groups advocate very early brain imaging and neurophysiological examination, although there are no definitive data to establish the therapeutic approach, whereas other groups advocate a more clinical approach to the problem, even though such an approach could delay the establishment of a prognosis.

Another controversial issue is the need to perform emergency cardiac catheterization. All groups agree on the need to perform emergency angiography in all patients with ST segment elevation. However, the use of systematic catheterization in all survivors of cardiac arrest has been questioned. Emergency catheterization does not delay the start of hypothermia but can prolong the time required to reach the target temperature and is not free from complications. Thus, the antithrombotic therapy associated with this technique, and especially with angioplasty, may cause or aggravate hemorrhagic complications, particularly in patients with lacerations in the abdominal organs or trauma and bruising as a result of cardiopulmonary resuscitation.

CARDIAC ARREST CENTERS

In 2010, the American Heart Association issued a statement in support of the creation of regional referral centers, known as cardiac arrest centers, to provide the postcardiac arrest care required by survivors of an out-of-hospital arrest.¹⁴ These centers were envisaged as being analogous to the regional systems for the management of stroke, multiple trauma, or acute coronary syndrome with ST segment elevation. The American Heart Association reasoned that the wide interhospital variation in the outcome of survivors of an out-of-hospital cardiac arrest could not be explained solely by differences in patient characteristics, suggesting that differences in hospital-based care play a major role in variations in outcomes across regions. Their rationale was also based on the results of similar processes, such as myocardial infarction care, which, due to the creation of referral centers for primary angioplasty, now show survival rates that were unthinkable only 10 years ago. The article published in *Revista Española de Cardiología*⁴ is the result of a collaboration among all the centers participating in the “Código Infarto” (Infarction Code) project of the Autonomous Community of Catalonia, which has improved all time frames related to myocardial reperfusion and patient prognosis.¹⁵ The concept of regional referral centers for the management of out-of-hospital cardiac arrest survivors is supported by numerous examples in various fields of medicine, which have shown a positive correlation between improved patient outcome and greater professional experience and a higher volume of diagnostic procedures and complex treatments. The benefit of volume on outcomes is particularly clear for those health conditions requiring a multidisciplinary approach. Thus, a large volume of patients with complex processes demands much more fluid coordination among the various professionals involved than is required in isolated processes.

Postcardiac arrest syndrome care is not based exclusively on the initiation of hypothermia treatment. Although the incidence of acute coronary syndrome with ST segment elevation varies, it can be as high as 50%. Consequently, cardiac arrest centers should ideally be equipped with a permanently available cardiac catheterization laboratory.⁴ In these patients, fibrinolysis may produce unnecessary risks, and the best option is mechanical reperfusion, if required. Many patients require complex neurological evaluation, and some survivors may also require subsequent electrophysiological assessment, often with defibrillator implantation as a secondary preventive measure, together with cardiac,

motor, and neuropsychological rehabilitation programs to treat possible sequelae.

In summary, despite the significant progress made in the last 10 years, the prognosis of out-of-hospital cardiac arrest survivors is poor. However, there is still a wide margin for improvement, and one of the possible means of making progress in the management of these patients is to concentrate their care in specialized centers. This approach would help to provide them with comprehensive treatment of all the processes involved and would hasten the acquisition of knowledge. Furthermore, a coordinated network consisting of distinct specialized centers, such as that proposed by Loma-Osorio et al., greatly facilitates research in this field.

CONFLICTS OF INTEREST

None declared.

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