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.6 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.7 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.8

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,9 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. 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 treat-
ment in the out-of-hospital setting should be encouraged, with
simple methods to minimize delays in its application.

Along similar lines, some findings suggest that, although
patients should be cooled as soon as possible, the target
temperature chosen also affects prognosis. 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 recom-
manded 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, 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. Surpris-
ingly, 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 manage-
ment 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 identifica-
tion 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.

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. 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 extra-
ordinary 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 manage-
ment 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.

CARICARD 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. 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 unthink-
able only 10 years ago. The article published in Revista Española de
Cardiología 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. The concept of regional referral centers for the
management of out-of-hospital cardiac arrest survivors is sup-
ported 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
catherization laboratory. In these patients, fibrinolysis may
produce unnecessary risks, and the best option is mechanical
reperfusion, if required. Many patients require complex neuro-
logical evaluation, and some survivors may also require subsequent
electrophysiological assessment, often with defibrillator implan-
tation 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.

REFERENCES