Rev Esp Cardiol. 2019;72(1):3–6

Editorial

From Prevention to Rehabilitation: Toward a Comprehensive Approach to Tackling Cardiac Arrest

De la prevención a la rehabilitación: hacia un manejo integral de la parada cardiaca

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Article history:
Available online 30 May 2018

Sudden cardiac death (SCD) is a major cause of mortality. Cardiovascular disease, particularly coronary artery disease (CAD), accounts for a significant proportion of out-of-hospital cardiac arrests (OHCA).[1] Despite a trend to decreasing mortality due to significant advances in the acute management of patients with myocardial infarction, increasing hospitalization rates reveal a growing burden of cardiovascular disease,[1,2] which is closely related to the occurrence of OHCA.

The notion of the "chain of survival" was introduced in the late 1980s to denominate the subsequent actions aimed at enhancing survival from cardiac arrest.[3] It included 4 steps: *a)* early access to emergency medical care, *b)* early cardiopulmonary resuscitation (CPR), *c)* early defibrillation and *d)* early advanced cardiac support. This chain was implemented virtually unchanged until 2010, when the final link was revised and substituted by "early postresuscitation care", understood as those measures that facilitate functional recovery after the return of spontaneous circulation. The metaphor emphasizes that the chain is only as strong as its weakest link, thus highlighting the importance of each step of the sequence to ensure optimal recovery from OHCA. However, this "linear conception" of chain of survival mainly focused on the acute attention and management of OHCA and might be insufficient nowadays. If considered from a global, public health perspective, reducing the risk of OHCA in the community would require tackling the problem at its roots, that is, by enhancing prevention of cardiovascular disease (since both conditions share similar predisposing factors) and population knowledge on basic life support.

Cardiac rehabilitation (CRH) programs provide a comprehensive approach to risk factor management and are strongly recommended by the leading cardiovascular scientific societies.[4] Although essentially focused on high-risk groups, they may have the potential to induce a change of habits in the community by means of health education and prevention, thereby eventually reducing the global risk of OHCA. CRH might also offer an optimal frame to promote bystander CPR and facilitate basic life support training among cardiac patients and their families, thus achieving dissemination of this knowledge to society.

Even though there is increasing awareness of the importance of prevention when addressing cardiovascular disease, there might be a need to explicitly underscore its role regarding OHCA. The linear, somehow broken-in-practice chain of survival, may require reappraisal to emphasize the role of prevention and continued awareness to comprehensively address the problem of SCD.

CURRENT TRENDS IN CARDIOVASCULAR DISEASE AND SUDDEN CARDIAC DEATH

Cardiovascular disease is responsible for 4 million deaths in Europe each year and remains the leading cause of mortality worldwide. Coronary artery disease is the major contributor to both mortality and morbidity, causing 1.7 million deaths (20% of all deaths) per year across the continent.[2] SCD, defined as unexpected death of cardiovascular cause, is the most deleterious and sometimes the first manifestation of cardiovascular disease, accounting for 15% to 20% of all deaths.[5] More than 70% of such events have a cardiac cause, with CAD underlying up to 80% of OHCA in adults, as a result of ventricular fibrillation in the setting of ST-elevation myocardial infarction in individuals with no prior history of heart disease, or due to ventricular tachyarrhythmia originating from a chronic ischemic substrate.[5,6] This fact supports the performance of early coronary angiography in postresuscitation care if ischemia is suspected.

Substantial progress has been made over the last few years in reducing mortality from myocardial infarction. This has been facilitated by the widespread use of early percutaneous coronary intervention, new highly effective medical therapies, and a better allocation and use of emergency resources, which have shortened the time from the cardiac event to hospital admission.[7] Despite remarkable improvements in acute care management, the sustained incidence of CAD, in addition to a nonnegligible risk of future events and mortality among survivors of acute coronary syndromes (especially within the first year but also beyond) have partly counterweighed these achievements.[8] This has resulted not

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https://doi.org/10.1016/j.rec.2018.04.021

only in a huge impact on patients' quality of life, but also in enhanced costs for health care and society.

Likewise, neurological outcomes and survival from OHCA have significantly improved over the last few decades. These findings may be explained by initiatives aimed at promoting bystander CPR, facilitating access to automated external defibrillators, reducing delay to medical attention, and improving evidence-based multimodal critical care. Nevertheless, rates of survival of admitted patients to hospital discharge vary markedly across countries but globally remain around 10%.[5] Studies such as that conducted by Hulleman et al.[9] have determined that the use of implantable cardioverter-defibrillators has reduced the incidence of ventricular fibrillation by one third, but have also indicated a falling proportion of defibrillable rhythms at initial presentation. This is consistent with recent observations of an increasing number OHCAs occurring at home and affecting older patients with comorbidities,[1,5] which may have contributed to persistent modest survival rates, and suggest a change in trend that should be considered in the future.

Improvements in lifestyle changes and risk factor modification have halved cardiovascular death rates in the last few years.[1,2,4] Nevertheless, a large majority of patients with known CAD fail to achieve the goals recommended by guidelines, and medication nonadherence remains as high as 50%.[10] Both professionals and patients tend to underestimate the role of secondary prevention and the attempts to implement such strategies have not been systematically organized. Hence, the absence of continuity of care might compromise the long-term success of all previous efforts to accomplish the best results during hospitalization and also at discharge.

Similarly, the modest survival rates from OHCA despite efforts directed at strengthening links in the chain of survival indicate that, although we are doing well, we need to do better. Improved access to medical care and advances in postarrest management have contributed to better outcomes, but not to a reduction in the number of OHCAs. This might only be achievable by means of global approaches that consider not only the treatment of OHCA, but also its prevention. The substantial risk of morbidity and mortality of OHCA among individuals with high cardiovascular risk (such as survivors of myocardial infarction) reflects the dynamic nature of the disease, with a recurrent and chronic course, and supports the need for sustainable secondary prevention strategies. Furthermore, the fact that more than 60% of all OHCAs occur as the first clinical manifestation of CAD or in individuals previously classified in a low-risk category,[6] highlights the role of primary prevention to reduce the burden of SCD in the community.

GATHERING EFFORTS IN PREVENTION: CARDIOVASCULAR REHABILITATION

Cardiac rehabilitation has progressed over the last decade and has become consolidated as a fundamental part of the standard of care in modern cardiology. Originally conceived to monitor patients' safe return to physical activity after myocardial infarction, current exercise-based CRH programs have broadly surpassed their modest origin to become an essential tool for secondary prevention. Although the structure and phases of these programs may differ, they share the conception of care and prevention as a continuous, lifelong processes, and include educational aspects as an essential component of a comprehensive, patient-centred approach.

Exercise-based CRH programs have been demonstrated to effectively mitigate symptoms and improve quality of life after myocardial infarction. In addition, significant reductions have been shown in readmission rates, new major adverse cardiovascular events, and cardiovascular mortality.[11] However, even though referral to a CRH program following a cardiovascular event is a class IA recommendation in the clinical practice guidelines,[4] prescription and adherence are far below desired rates and vary broadly between hospitals and countries.[12]

These programs may not only have a sizeable impact on the quality of life, social reintegration and risk of subsequent events of patients after myocardial infarction or revascularization. They may also represent a unique opportunity to combine efforts in secondary prevention and education, and drive them effectively to ensure optimal lasting results, leading a change of scope when attempts are made to tackle cardiac arrest. CRH offers additional advantages in this regard. First, it may be the best environment for the cardiac and neurological rehabilitation of survivors of OHCA, providing specific resources of psychological assessment for patients and their families. Second, it can improve lung function and reduce the risk of several diseases that could be prevented through exercise. Third, CRH education programs may facilitate training the families of patients at increased risk of cardiac arrest in basic life support and CPR, which should be an important educational objective not yet present in all CRH programs.

Of importance, more than half of all OHCAs are witnessed and usually occur at home.[1,5] The recommendation to facilitate training in basic life support to those most likely to encounter an OHCA,[13] such as the families of patients with CAD, has not been fully matched by appropriate strategies and measures. Since participants in basic life support courses are usually younger than potential witnesses of cardiac arrest and both differ significantly in their profiles, reaching this high-risk population still poses a challenge in laypeople training.

Valuable initiatives have attempted to disseminate basic life support training among cardiac patients and their families, with good overall acceptance. Recent experiences assessing different CPR training methods in the context of a CRH program, including self-instruction[14] or hands-on CPR rolling refreshers integrated in an exercise-based program,[15] have reported encouraging results, with noticeable improvement in participants' skills in basic life support, increased self-confidence, and willingness to help. Given its multidisciplinary and patient-centred scope, CRH may offer an optimal frame to promote this learning and make it accessible to a sensitized population. Hence, both patients and their families may become active agents to promote not only healthy behaviors and prevention in their environment, but also bystander resuscitation.

SEARCHING FOR THE CONTINUUM OF CARE IN CARDIAC ARREST: THE CIRCLE OF SURVIVAL

Even though the usefulness of the well-established links of the chain of survival is beyond discussion, ensuring survival might not be enough, and there may be a need to go one step further. If we admit that *"the strength of the chain is only as strong as its weakest link"*, it is in this gap in prevention and long-term aftercare where the greatest weakness of the chain of survival lies: a previously nonspecifically named or "missing link".[16]

The inclusion of this new link of cardiovascular prevention and CRH as the step preceding "early access to emergency medical care" (by promoting primary prevention policies to address cardiovascular risk in the community, which parallels that of OHCA) and following "postresuscitation care" (by facilitating survivors the best conditions to return to their lives and by promoting secondary prevention and basic life support education), would close the sequence and lead to a circular chain or "circle of survival" (Figure), proposed as an enhanced alternative to the current model. This is consistent with the concept of continuity of care and awareness, which is essential to tackling cardiac arrest from a comprehensive perspective: primary prevention among

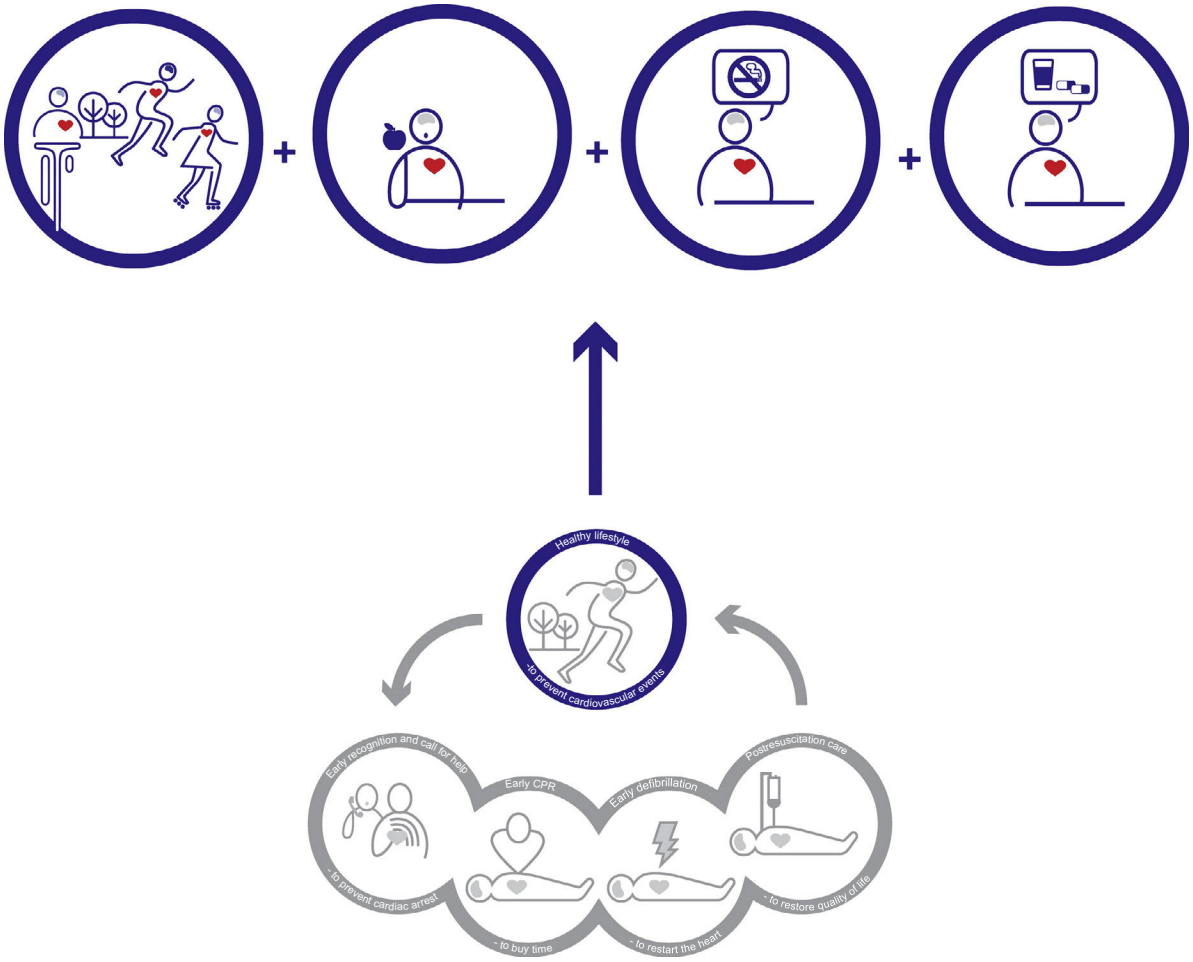

Figure. Suggested model of the "circle of survival" with details of the core components of the new cardiovascular prevention and cardiac rehabilitation link. CPR, cardiopulmonary resuscitation.

healthy individuals and risk factor control among those with established cardiovascular disease might be crucial before any further significant impact can be achieved.

In conclusion, significant improvements of outcomes after OHCA in the last few decades have been made possible by continued multifaceted efforts to strengthen the chain of survival, which is mainly focused on acute management but has not specifically addressed prevention. The fact that cardiovascular disease and especially CAD underlies most OHCAs highlights the role of cardiovascular prevention strategies to reduce the burden of SCD in the community. CRH provides a multidimensional approach to implement these policies, maintaining the progress achieved in acute care and facilitating basic life support training among patients at increased risk of OHCA and their families, who may bring this knowledge to society. It should thus be considered as an essential link in this new, reappraised circular model of care or "circle of survival".

ACKNOWLEDGEMENTS

The authors would like to thank Carlos Peña Gil, Matthias Wilhem, Cristina Varela Casal, Alberto Ruano Raviña and Roberto Barcala Furelos for their contribution in the development and shaping of the idea of the "circle of survival".

CONFLICTS OF INTEREST

None declared.

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