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REVIEW

Cardiopulmonary resuscitation and use of the automatic external defibrillator in sport



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Abstract Cardiac arrest during sport practice is a low-incidence event, however, as it is commonly seen witnessed to have a high survival rate compared to general non-hospital cardiac arrest. The objective of this review is to analyze the special characteristics, give recommendations for the installation of automatic external defibrillators and the elaboration of an adequate medical action plan for each sports center.

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PALABRAS CLAVE

Reanimación cardiopulmonar;
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Reanimación cardiopulmonar y uso del desfibrilador externo automático en el deporte

Resumen La parada cardíaca durante la práctica de deporte es un evento de baja incidencia, sin embargo, al ser habitualmente presenciado presenta una tasa de supervivencia elevada si se compara con el paro cardíaco extra-hospitalario en general. El objetivo de esta revisión es analizar las características especiales, dar recomendaciones para la instalación de desfibriladores externos automáticos y elaboración de un plan de acción médica adecuado a cada centro deportivo.

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Sudden cardiac death (SCD) during sports is a rare event, with an estimated 1–2 cases per 100,000 athletes year incidence¹ however, it has a large impact on media and society in general.

In a practical approach to this problem of public health, it described the “rule of 5” of the SCD in sport; because it represents 5% of the total incidence in the general population SCD,² occurs in 5% in females,³ 5% occurs in competitive athletes,⁴ however, the competitive athletes have a relative risk 5 times higher than those practicing sport recreationally.⁴

The incidence of SCD in sport increases with age,⁵ and from the age of 35 the main cause is atherosclerotic coronary disease, which multiplies by 4 times its incidence, in relation to the youngest.⁶ In individuals under 35 years of age, the causes of SCD during sports are mainly congenital and hereditary heart diseases that affect heart morphology and electrical impulse conduction disorders.⁷ In both cases the alterations can generate complex arrhythmias triggered during the physical exercise, that finally are causes of the cardiac arrest during the sport practice.

For the prevention of SCD in sport, pre-participation screening has been proposed with the medical history, physical examination and ECG of the athlete, however, in some cases there may be false negatives, in congenital diseases such as incomplete forms of expression of cardiomyopathy, anomalies of the origin of the coronary arteries, early coronary disease; and other acquired diseases such as commotio cordis, myocarditis or hydroelectrolytic disorders.⁸

According to the studies of Marijon et al.^{2,4} in more than 90% of the cases of cardiac arrest (CA) during sports were witnessed,² being the early onset of cardiopulmonary resuscitation (CPR) maneuvers, which was carried out in one third of the cases, the main determinant of a better survival rate and better neurological status at hospital discharge.⁴

The survival rate after a CA can be up to about three times higher when it occurs during sports practice compared to those in which CA occurs outside the sports field, although according to results of the same study⁹ the highest survival is only seen in those over 35 years. In athletes under 35 years of age, the low incidence of SCD makes it difficult to find evidence to support prevention strategies, however, in a study conducted in a total of 2149 secondary education institutes in the United States with 39 cases of CA during the sports practice, 89% survival rates were found in both young and adult patients in relation to early CPR and the use of automatic external defibrillator (AED).¹⁰

A good communication system to the local medical emergency services is also essential to increase the chances of survival of the athlete, and in its simplest form must include at least one mobile phone and know the location of the sports facility to facilitate the access. It is expected that in the coming years there will be a greater number of organizers, referees, coaches, physical trainers, athletes and even spectators who have received training in CPR and use of the DEA. Currently, we have simple tools such as the CPR11 mobile phone application, which is part of FIFA F-MARC's emergency prevention and management strategies, which can be downloaded free of charge and with videos, sound and text is intended to teach anyone without previous medical training how to act before a CA of an athlete.¹¹

In this context, the purpose of this document is to offer recommendations based on the scientific evidence available for the development and implementation of medical action plans (MAP) that include the installation of a DEA in sports centers in order to guarantee an adequate and early response to a CA.

Priori et al.¹² make no mention of the special situation of cardiac arrest during sports practice; however, in the year 2015 the guidelines of the European Resuscitation Council include this paragraph for the first time as a special situation,¹³ and reaffirm the importance of prior organization of the response to a PC and immediate defibrillation.

The guidelines recommendation in 2004 year, for the use of the AED by the European Society of Cardiology and the European Resuscitation Council¹² makes no mention of the special situation of cardiac arrest during sports practice, however, in the year 2015 the guidelines of the European Resuscitation Council include this paragraph for the first time as a special situation,¹³ and reaffirm the importance of prior organization of the response to a CA and immediate defibrillation.

In relation to large sports facilities where sports competitions (stadiums, halls, etc.), the European Society of Preventive Cardiology held, recommended in a consensus document the existence of a MAP and installation of a DEA to ensure then one response from a CA, the presence of at least a nurse and a physician if the capacity exceeds 1000 spectators and athletes.¹⁴ The plan must be tailored to each facility, so that human resources (doctors, nurses, emergency medical technicians), clinics or attention stations, mobile units of life support and defibrillators, should be required to meet response times suitable to a CA (1 min. to begin CPR and 3–5 min. to use the defibrillator).⁸

In Catalonia there is legislation relating to the installation and use of AEDs,¹⁵ and self-protection measures by different centers.¹⁶ While not a sports centers referred to in Annex III, one can extrapolate the requirement of an AED for each establishment with more than 1000 people capacity. However, the MSC mentioned above in the context of sport is a particular situation; with a low incidence in relation to total extra-hospital cardiac arrest, but with a higher relative risk if we assume the exposure time, and in turn it represents the PC with greater possibility of effective resuscitation by habitual presence of witnesses.²

When a CA is witnessed, the hospital survival rate and the neurological status are significantly better,^{17,18} so the recommendations suggest the existence of a MAP in the stadiums with capacity above 1000 spectators¹⁴ With personnel with the appropriate training and experience in life support (basic and/or advanced), and a coordinator to be a physician trained in extra-hospital must lead the emergency device, unusual but essential condition emergencies.

In Catalonia, the legislation allows anyone to use an AED¹⁹ and there is a decree regulating CPR training,¹⁵ which must be obtained by at least one responsible for coordinating the MAP in each sports center, in order to improve the operation of the chain of survival. There are four basic elements for the success of a CPR program in the extra-hospital setting: (1) planned and practiced response, (2) training in CPR and AED use, (3) Automatic system of medical emergency notice, and (4) maintenance DEA.²⁰

The studies that have evaluated the cost-effectiveness of the DEA installation in public places, in turn performing an analysis by the type of place in which cardiac arrest occurs and using the Markov analysis model, estimate a cost for Sports facilities and gyms of between US \$ 45,000²¹ and US \$ 136,000²²; however, in these studies it is not detailed the number of athletes that attended each sport center analyzed.

In conclusion, due to the higher relative risk of having an SCD during sports practice, the higher survival rate in CA cases witnessed, and cost-effectiveness analyzes with theoretical models; we consider useful the preparation of a MAP that includes the training in CPR of first responders and the access to a DEA with connection to the local medical emergency system, in each sports center and stadiums with a capacity of more than 1000 people.

Conflicts of interest

The authors did not report any conflicts of interest in this article.

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