

Sudden Cardiac Death in Rugby Clubs

Muerte súbita en clubes deportivos de rugby

MARIO FITZ MAURICE², FERNANDO DI TOMMASO, MARÍA C. BARROS PERTUZ¹, WALTER ÁLVAREZ MENDOZA¹, DAMIAN SPAGNUOLO¹, VANINA LUCAS¹

ABSTRACT

Background: Sudden cardiac death accounts for approximately 12% of all natural deaths and around 50% of cardiovascular deaths in developed countries. The advent of the automated external defibrillator has allowed understanding that its early use in conjunction with cardiac resuscitation increases the chances of survival to 80% if applied in the first minute.

Objectives: The aim of this study was to describe the characteristics (available automated external defibrillators at the institution, their current number, location, presence of signaling, availability of resuscitation algorithms, cases in which it was required) and the rate of mortality due to sudden cardiac death in people attending events organized in Argentine Rugby clubs.

Methods: This was an observational, retrospective, descriptive, cross-sectional study in which 137 rugby clubs belonging to the Buenos Aires Rugby Union and provincial rugby unions were included in a training program in cardiopulmonary resuscitation to the community and non-medical personnel from January 2012 to June 2017. Some of these clubs previously received as a donation an internationally validated Zoll™ automated external defibrillator, and others acquired a Cardiac Science™ defibrillator. Follow-up was carried out for 5 years through telephone contact in order to record the cardiovascular events that occurred during that period and the use given to the defibrillator.

Results: The automated external defibrillator was used in 7 out of 100 clubs with defibrillator availability (7%), resulting in an overall use in 8 patients. In 88% of cases the victim of sudden death was a player, and in 12% a spectator. Mortality in the field was 25% (2 deaths in the field), and 100% of survivors reached the hospital alive. The annual incidence of sudden death in rugby players was 1.7/100,000.

Conclusion: The implementation of training programs in cardiopulmonary resuscitation maneuvers and access to automated external defibrillators in rugby clubs of Buenos Aires and other provinces proved to be useful in the early access of victims of sudden death events.

Key words: Sudden death - Automated external defibrillator - Cardiopulmonary resuscitation.

RESUMEN

Introducción: La muerte súbita cardíaca representa aproximadamente el 12% de todas las muertes naturales y alrededor del 50% de las muertes de origen cardiovascular en los países desarrollados. La aparición del desfibrilador externo automático ha permitido comprender que su utilización precoz en conjunto con la reanimación cardíaca aumenta las chances de supervivencia a un 80% si esto se aplica en el primer minuto.

Objetivos: Describir las características (disponibilidad actual de desfibriladores externos automáticos en la institución, cantidad de estos en la actualidad, su localización, presencia de señalización, disponibilidad de algoritmos de reanimación, casos en los cuales se requirió la utilización de uno) y la tasa de mortalidad por muerte súbita cardíaca en personas que concurren a eventos organizados en clubes de Rugby de Argentina.

Material y métodos: Estudio retrospectivo descriptivo observacional y transversal en el cual se incluyeron 137 clubes de rugby pertenecientes a la Unión de Rugby de Buenos Aires y del interior, en los cuales durante enero de 2012 y junio de 2017 se llevó a cabo un programa de entrenamiento en resucitación cardiopulmonar a la comunidad y al personal no médico. Estos clubes previamente recibieron como donación un equipo de desfibrilador automático validado internacionalmente de marca Zoll, y en otros casos adquirieron mediante compra desfibriladores marca Cardiac Science. Se realizó seguimiento durante 5 años mediante contacto telefónico, a fin de registrar los eventos cardiovasculares ocurridos durante ese período y el uso dado al desfibrilador.

Resultados: El desfibrilador externo automático fue utilizado en 7 de los 100 clubes con disponibilidad de este (7%), en total se usó en 8 pacientes. En el 88% de los casos la víctima de muerte súbita fue un jugador, y en el 12% fue un espectador. La mortalidad en el campo fue del 25% (2 muertes en el campo), de los sobrevivientes, el 100% llegó vivo al hospital. La incidencia anual de muerte súbita en los jugadores de rugby fue 1,7/100.000.

Conclusión: La implementación de programas de capacitación en maniobras de resucitación cardiopulmonar y el acceso a desfibriladores externos automáticos en clubes de rugby de la provincia de Buenos Aires demostró utilidad en el acceso precoz de víctimas eventos de muerte súbita.

Palabras claves: Muerte súbita - Desfibrilador externo automático - Resucitación cardiopulmonar

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Address for reprints: Mario Fitz Maurice - Servicio de Cardiología - Hospital Bernardino Rivadavia - Av. Las Heras 2670 (1425) CABA
e-mail: mdfitzmaurice@gmail.com

¹ Department of Cardiology, Hospital Bernardino Rivadavia. Buenos Aires, Argentina.

² INADEA.

Abbreviations

AED Automated external defibrillator
CPR Cardiopulmonary resuscitation

SD Sudden death

INTRODUCTION

Sudden death (SD) represents one of the most important challenges in cardiology, affecting 0.1% of the adult population. In most cases, it is triggered by a cardiovascular event (60-70% of cases), and coronary heart disease, with or without known history of cardiovascular disease, accounts for 70% to 80% of cases. Non-cardiac causes are proportionally much less important. Arrhythmia is the most frequent cause of SD and ventricular fibrillation is responsible in 85-90% of cases. (1)

Sport is a major event in today's society. The SD of an athlete in full performance, young and apparently healthy, is a devastating event with great social and medical impact and repercussions on the family, other athletes, and public opinion. (2) The SD of an athlete is the one that happens unexpectedly, not traumatically or violently and in a short time period, and whose symptoms appear during or in the hour following sports practice. (3)

The relationship between the incidence of SD and the intensity of exercise is well known. While physical activity is a protective factor of ischemic heart disease, intense exercise is a trigger of cardiac SD. High performance athletes have higher cardiovascular mortality. The real frequency of SD in athletes is not exactly known; however, the estimated annual incidence is 1/100,000 in young individuals under 35 years of age and 1/15,000-50,000 among older athletes. The prevalence is higher in men, with a ratio of 9 to 1 with respect to women. (4) It is important to note that SD is not limited to elite athletes, as it is also observed during recreational activities in non-athletes.

Sudden death is usually due to previous undiagnosed cardiovascular diseases. In athletes under 35 years of age, the main causes, in order of frequency, are hypertrophic cardiomyopathy, coronary artery anomalies, and right ventricular arrhythmogenic dysplasia. In the absence of structural heart disease, Wolff-Parkinson-White syndrome, Brugada syndrome, long QT syndrome, short QT syndrome, and catecholaminergic polymorphic ventricular tachycardia (CPVT) are the most important causes. In those over 35 years of age, as in the general population, the main cause of SD is ischemic heart disease. (5, 6)

Prevention strategies should include the identification of pathologies that can cause SD and the availability of external defibrillators in sports centers. (2) In general, the underlying cardiovascular problems can be detected with standardized studies (electrocardiogram, Doppler echocardiogram and cardiac stress test), which become important for risk stratification when performed by qualified staff. (7) In case of elite

or highly competitive athletes, it may be necessary to include additional studies to those usually used, such as coronary perfusion studies.

Despite these precautions, the limited knowledge of some of these pathologies (many of them of genetic origin), associated to the fact that they not always manifest in routine complementary studies, persists in a subgroup of athletes in which it is not yet possible to prevent an event of SD, and this is precisely why the dissemination and training of resuscitation techniques and the use of cardiac defibrillators becomes highly relevant.

Therefore, with the aim of evaluating the ability to apply rescue measures to events of SD in crowded gatherings, a descriptive observational study was performed in 107 rugby clubs of the Buenos Aires Rugby Union and provincial rugby unions. Given that there is a large number of clubs involved, in which high performance athletes train every day and that, at certain times (mainly the days of competition), there is a large crowd attendance, the probability of an event of SD is greater than in other circumstances.

The aim of this study was to describe the existence and availability of automated external defibrillators (AED) at each institution, the number of defibrillators, presence of signaling, availability of resuscitation algorithms, cases in which the use of an AED was required and mortality by cardiac SD in players and people who attended events organized in rugby clubs belonging to the Buenos Aires Rugby Union (URBA) and provincial rugby unions (UI).

METHODS

A retrospective, observational, descriptive study conducted between January 2012 and June 2017 included 137 rugby clubs belonging to URBA/UI, in which a cardiopulmonary resuscitation training program was carried out to the community and to non-medical personnel over 15 years of age. Some of these clubs had previously received as a donation an internationally validated Zoll™ EAD, and others acquired a Cardiac Science™ defibrillator. Among the 137 clubs, only 100 had an AED available and functioning at the time of data collection. The training program consisted of a 60-minute presentation with emphasis on the importance of immediate treatment of the witnessed SD, especially by a common spectator, as well as a demonstration of the use of the AED and a series of questions where doubts were answered to the audience. Follow-up was carried out for 5 years by means of a telephone survey, in order to record the cardiovascular events that occurred during that period and the use given to the AED (Figure 1). Thirty clubs in which it was not possible to obtain the information intended were excluded from the study.

Ethical considerations

The protocol of this study was approved by the Ethical Committee of the institution.

RESULTS

Among the 137 clubs, 100 had an AED ready for use (73%), with an average of 1.1 devices available per site and 26.5 months on average of device availability; no center had less than 12 month availability. Thirty clubs were excluded due to lack of the information they were trying to collect. Of the remaining 107 clubs included in the analysis, 100 had an AED (93.5%), with an average range of 0 to 6 and 1.1 device available per site. The most frequent AED location was the restaurant/bar (34.2%), followed by the doctor's office (23.1%), infirmary (10.3%), secretary office (7.7%), and others (24.8%). While all the clubs were given signage for AED location and a resuscitation algorithm, 61 (61.0%) had a formal signaling system for AED location within the institution and only in 37.0% had algorithms for cardiopulmonary resuscitation and AED use.

The AED was used in 7/100 clubs (7%). In one club it

was necessary to use the AED in more than one patient, so that overall, this was used in 8 patients, of which 100% belonged to the male gender. In 88% of cases, the SD victim was a player, and in 12% a spectator.

Field mortality was 25% (2 deaths in the field) and 75% of the victims survived (Figure 1), among which 100% reached the hospital alive. In 75% of cases, patient assistance was performed by a doctor, while the remaining 25% was assisted by a player. The total number of players affiliated to URBA/Argentine Rugby Union (UAR) is approximately 112,000, and about 81,750 belong to the analysis of the 100 clubs entering the study. Follow-up was almost 5 years, and the observed annual incidence of SD in rugby players was 1.7/100,000.

Of the 7 clubs where the AED was used, 57% had a signaling system and 43% had algorithms of cardiopulmonary resuscitation and use of AED.

Fig. 1. Structure of the questionnaire used to collect data on the availability and use of automated external defibrillators (AED)

1. Do you have an AED on the premises?
 2. How many AEDs are currently available at the institution?
 3. Where is the AED located? (open question that was categorized):
 - a. Secretary office.
 - b. Infirmary.
 - c. Medical office.
 - d. Superintendent's office.
 - e. Restaurant/bar.
 - f. Field.
 - g. Changing room.
 - h. Administration.
 - i. Main hall.
 - j. Entrance hall of public access.
 - k. Reception.
 - l. Entrance security
 4. Do you have an AED signaling system available? (The information provided through billboards for the location of the AED, according to what is indicated in the corresponding training, is considered signaling).
 - a. Yes
 - b. No.
 5. Do you have algorithms for cardiopulmonary resuscitation and AED use? (It was asked whether there was a sequence of steps to be followed when an episode of sudden cardiac death occurs).
 - a. Yes.
 - b. No.
 6. Was the AED ever used?
 - a. Yes
 - b. No.
- If the answer is affirmative:
- i. How many subjects required AED?
 - ii. What was the gender of the patients requiring AED?
 - iii. Who presented the episode of sudden cardiac death: a player or a spectator?
 - iv. How many of those people died?
 - v. In each case, who assisted/used the AED?
 - vi. How many patients died before arriving at a healthcare institution?

DISCUSSION

Population healthcare policies applied correctly and in the right context are essential to reduce morbidity and mortality and to improve the quality of life of the population that receives them. The best strategies are carried out when there is appropriate knowledge of the health problems that affect the population on which healthcare standards are to be improved.

In recent decades, there has been a significant reduction in cardiovascular morbidity and mortality, achieved with the progress in primary prevention measures (mainly control of risk factors) and secondary prevention, aimed at fighting the main etiology responsible for the highest percentage of deaths from cardiological causes: acute and chronic coronary heart disease. (8)

However, and despite all the measures applied, cardiovascular disease continues to be the main cause of morbidity and mortality in developed countries. And one of the reasons that explains this high incidence is found in the large number of SD events that occur in the out-of-hospital setting.

Although we know that subjects over 60 years of age are the ones most affected by SD during sports, this is balanced by the benefit associated with physical activity. (9)

Among the total number of SD in middle-aged people between 35 and 65 years old, only 5% occur during sports practice. On the other hand, young high-performance athletes - under 35 years of age - represent a population at higher risk of SD compared with non-athletes of the same age group (taking into account that young people, in general, represent a population with lower risk of SD). (10)

Although the prevalence of pathologies that predispose young people to SD (mainly channelopathies and cardiomyopathies) is similar in both groups, intense physical activity increases the risk of severe cardiovascular events. (11)

In this group, a precompetitive cardiovascular examination allows, in some cases, to diagnose these pathologies and suspect them in others, thus preventing subject's exposure to high-performance training. The high mortality associated with these events is due to the fact that the majority occurs outside the hospital (in this case, it usually happens in the area where the victim's sporting activity takes place).

Morbidity and mortality of these events is inversely proportional to the time delay from SD occurrence to initiation of basic and advanced cardiopulmonary resuscitation (CPR) maneuvers. In this "critical" period, in addition to the physical closeness of some person to the victim, the rapid and adequate recognition of the cardiac arrest situation plays a fundamental role in initiating the resuscitation maneuvers without delay. (12) A recent publication analyzes SD events in athletes through YouTube videos, clearly prioritizing airway clearance "supposedly obstructed by the tongue," which considerably delays the onset

of chest compressions. (13)

Taking into account these fundamental variables for the patient's prognosis, significant progress has been made in recent years in the dissemination of CPR techniques in the out-of-hospital setting aimed at training the non-medical population, and of public access programs to AED available in areas with large crowd assemblies. (14, 15)

However, the vast majority of developed countries are still far from having universally implemented policies to endow the majority of the adult population with skills aimed at actively intervening in an out-of-hospital SD situation, and less still having AED devices available in most places of large group gatherings.

In developing countries, these deficiencies are much more marked, and the lack of implementation of policies for the prevention of SD is far from that of developed countries.

Regarding the different techniques divulged in the training of the general public in CPR maneuvers, the technique of CPR ("Hands only CPR"), published in the latest guidelines as the technique of preference when a dispatcher of the emergency system has to orient the witness of an SD, has become relevant in recent years. This is also reflected in an increase of "CPR attempts" made by witnesses of an SD event, as described by the Swedish national registry, with more than 20,000 reported cases of SD in the out-of-hospital setting and similar survival rate compared with the traditional CPR technique (massage and ventilation). In conclusion, CPR training "only with hands" generated a significant increase in the number of people willing to try to help someone in a situation of cardiac arrest, showing the same level of efficacy as traditional CPR techniques, with a similar number of patients arriving alive at the hospital than with techniques that include ventilation. A recent review shows that in cases of out-of-hospital SD events that are defibrillated before the arrival of the emergency system, the median survival to hospital discharge is 40%. It is even greater when defibrillation is done by witnesses (53%) than by professionals, whether firefighters or policemen (28.6%). (16)

The analysis of results shows data that encourage the implementation of large-scale measures in different areas of highly crowded gatherings. The availability of AED and the knowledge of basic CPR maneuvers by the public allowed a higher percentage of subjects to enter the hospital alive after an SD event than those receiving no assistance.

The fact that this registry involves rugby clubs, that in Argentina are traditionally attended by athletes and public of high socio-cultural level, should not be considered a limitation of this study, since the techniques of CPR are easily taught and understood by the adult population in general. The results published in this registry contribute to the large volume of information available throughout the world, which shows that out-of-hospital SD is one of the main causes of

morbidity and mortality and is still poorly addressed by the health authorities. In turn, it reaffirms our conviction that the instruction of the general population in CPR techniques should be a public health issue, and its implementation should be available to the entire population.

CONCLUSIONS

The implementation of training programs in CPR maneuvers and access to AED in URBA/UAR rugby clubs proved useful in the early access to victims of SD. The data of the present observational study obtained through telephone surveys to the clubs involved showed that both access, signaling and training in the use of devices allowed fast attention of SD events. Among a total of 8 events of SD, all received primary care and had access to an AED, and 75% of them reached the hospital alive.

Conflicts of interest

None declared. (See authors' conflicts of interest forms on the website/Supplementary material).

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