Ventricular Fibrillation During Sport Activity Successfully Treated

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Survival after out-of-hospital cardiopulmonary arrest is estimated at less than 5%. We report a case of ventricular fibrillation during sports activity. Cardiopulmonary resuscitation was initiated early by a layperson, and defibrillation was successfully performed within less than three minutes, with an automated external defibrillator. The public access to defibrillation programs has increased the survival after out-of-hospital ventricular fibrillation. We should encourage the training of laypeople in relation to the use of automated external defibrillators and the Basic Life Support program by stimulating their implementation in places where large numbers of people gather or where people are at a high risk of sudden death, as is the case of sports centers.

Introduction

Approximately 250 thousand people die suddenly in the United States in an out-of-hospital setting every year[1]. In 40% of the victims, the initial rhythm is ventricular fibrillation (VF)[2]. Actually, a higher proportion of individuals may present VF at the beginning of the collapse, since delayed treatment of cardiopulmonary arrest (CPA) may cause many cases to progress to asystole at the moment of the first assistance, because initial VF not promptly treated may degenerate into asystole[2].

Case report

The patient is a 53-year-old black man who was a former professional basketball player. He had a history of hypertension, and during a veterans game in a traditional Sports Club he experienced sudden loss of consciousness. A club employee who had been recently trained in Basic Life Support was the first to assist the patient: he identified CPA and promptly required an automated external defibrillator (AED) and asked the club medical team to be called. The AED recommended shock, which was delivered 3 minutes after the collapse. The device did not recommend subsequent shocks; however, as the victim did not yet present evidences of blood flow, the cardiopulmonary resuscitation (CPR) procedures were maintained; spontaneous circulation was resumed three minutes later. A few minutes later, his heart rate was 140 bpm and blood pressure 220/120 mmHg; amiodarone and nitroglycerin were then administered intravenously.

The patient was transferred to a hospital nearby, where he stayed for 12 hours. After stabilization, he was transferred to a University Hospital specialized in Cardiology. At admission, his physical examination was normal. Enzyme determination showed total CK 1750 U/L, CKMB 11.6 ng/mL and troponin 0.95 ng/mL.

The electrocardiographic tracings were retrieved from the AED. The initial rhythm recorded was VF. After the shock, asystole could be observed (Figure 1A). Heart beats progressively appeared, characterizing an atrial fibrillation rhythm (Figure 1B).

The electrocardiogram performed at the University Hospital showed sinus rhythm, left ventricular overload, and ventricular repolarization abnormalities (Figure 1C). Transthoracic echocardiogram showed concentric left ventricular hypertrophy and systolic dysfunction, with a 38% ejection fraction. The patient underwent coronary angiography which showed irregularities in the right and left coronary arteries. The first diagonal of the anterior descending was obstructed. A 70% obstruction could be seen in the atrioventricular branch of the circumflex artery, ahead of the point where the left marginal artery arised; this latter presented an 80% ostial obstruction (Figure 2A).

Stent angioplasties were successfully performed in the circumflex and left marginal arteries (Figure 2B). A cardioverter-defibrillator was implanted, and the patient recovered uneventfully. Now,one year after the event, the patient is asymptomatic and leading an active life. Control transthoracic echocardiography showed normal left ventricular systolic function, with 67% ejection fraction.

Discussion

The likelihood of survival after out-of-hospital CPA increases if CPR procedures and defibrillation are promptly performed by bystanders. The American Heart Association has traditionally used the four-link chain of survival metaphor to illustrate the importance of these actions[3]. The links are:

1) Early recognition and activation of the emergency medical system;

Key Words

Ventricular Fibrillation; Exercise; Cardiopulmonary Resuscitation; Defibrillators.

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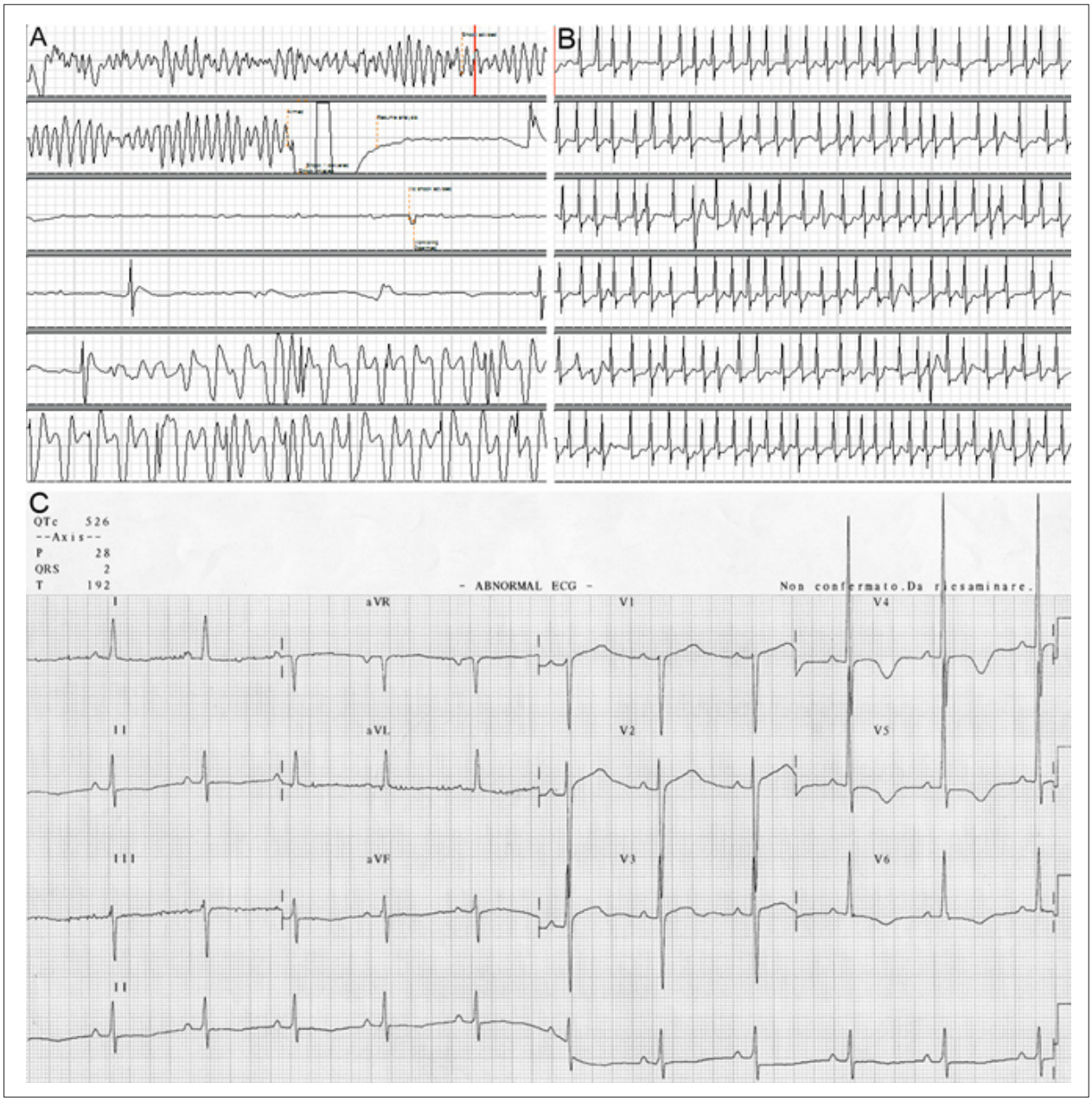

Figure 1 - A - VF rhythm and shock recommended by the AED, resulting in asystole. CPR initiated; B - Atrial fibrillation rhythm coinciding with resumed spontaneous circulation; C - Baseline electrocardiogram showing sinus rhythm, left ventricular overload and ventricular repolarization abnormalities.

2) Early CPR;

3) Early defibrillation;

4) Early Advanced Cardiac Life Support.

The success of the actions is time-dependent. For each minute elapsed between the collapse and defibrillation, the likelihood of survival decreases by 7% to 10% if CPR is not initiated[4]. Laypeople can perform the first three links. In most of the communities, the interval between the collapse and the arrival of the emergency medical system is of 7 to 8 minutes or longer. This means that the victims depend largely on lay rescuers during the first minutes of CPA. CPR provides blood flow to the heart and brain and increases the chance of resuming an organized rhythm after defibrillation. This seems particularly important if shock is not delivered within up to 4 minutes after the collapse[5].

Lay rescuers can use automated external defibrillators; by means of voice and visual prompts; these devices guide the steps to be taken and recommend shock when the rhythm is VF or ventricular tachycardia. The Federal Council of Medicine allows any person to perform CPR and use AED in the absence of a physician, provided they have been trained in a specific course given by health-related societies.

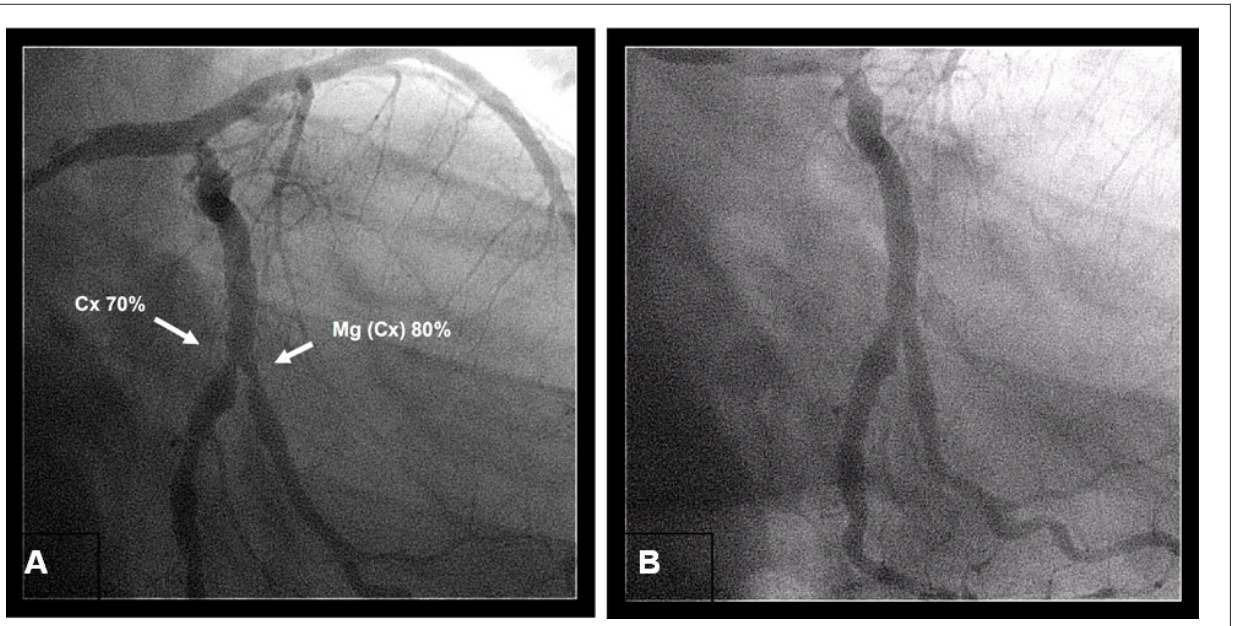

Figure 2 -A - Right anterior oblique view, circumflex (Cx) artery with 70% obstruction and left marginal (Mg(Cx)) with 80% obstruction; B - Result of successful coronary angioplasties.

Public Access to Defibrillation programs, which distribute automated external defibrillators throughout the communities, not only train a large number of people on Basic Life Support, but also increase the number of CPA victims receiving CPR, and decrease the time to defibrillation, thus increasing the number of survivors. Studies in small communities, as in airports[6] and casinos[7], have demonstrated an excellent survival to VF, of 49% and 74%, respectively. The present case is an excellent example of the importance of these programs. Not only the acquisition of equipment, but mainly planning and training with simulations is what makes people take the initiative in the assistance, thus demonstrating that sudden death is not necessarily a definite biological death, but rather a potentially reversible situation. Several laws and bills on these programs are being phased in in Brazil. Some laws have already been passed in the cities of Londrina and Sao Paulo; however, nationwide acknowledgment of the relevance of these programs can only be reached when encompassing national laws are in effect.

Among the causes of sudden death, coronary artery disease accounts for 80% of the events, and cardiomyopathies for 10% to 15%. Other causes include congenital or secondary cardiomyopathies (hypertension, heart valve diseases, etc.), different congenital heart diseases, diseases resulting in abnormalities of the electrophysiological mechanisms, as well as infiltrative, neoplastic and degenerative myocardial disorders. It is important to mention that the most probable cause that triggered CPA in this patient was hypertensive cardiomyopathy, which is known to cause myocardial ischemia during physical exercises. Although coronary artery disease cannot be fully ruled out as the cause of VF in this patient, it only compromised a small portion of the ventricular mass and no troponin elevation was observed.

Cardiopulmonary arrests can result in myocardial stunning and ventricular dysfunction[8], which can persist for days or even weeks, and can improve with the use of vasopressors[9]. Thus, fluid, vasoactive drugs or vasodilators can be necessary to sustain blood pressure, cardiac index, and systemic perfusion. The optimal blood pressure level and hemodynamic parameters associated with improved survival have not yet been established. In this patient, significant hypertension was observed after CPA, and intravenous vasodilators were required. Likewise, moderate ventricular systolic dysfunction was observed, with no signs of low cardiac output or need for vasoactive drugs. Perhaps these clinical and hemodynamic parameters characterize patients with a better prognosis after CPA.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

This study is not associated with any post-graduation program.

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