

## Prehospital Cardiac Arrest. Public-Access Defibrillation

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### SUMMARY

Cardiovascular disease is the leading cause of death in countries like ours with urban areas. Most of these deaths occur in the prehospital setting and a rapid response with cardiopulmonary resuscitation and early defibrillation are necessary to maximize survival. We describe the case of a subject who suffered a cardiac arrest while walking in the public thoroughfare and was successfully resuscitated with early defibrillation using an automated external defibrillator. The electrocardiograms obtained during the episode are included and the importance of the concept of public access defibrillation is emphasized.

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**Key words >** Cardiopulmonary Resuscitation - Automated External Defibrillator - Cardiac Arrest

### Abbreviations >

<b>CASA:</b> Acetylsalicylic acid	<b>ECM:</b> External cardiac massage
<b>MV:</b> Mechanical ventilation	<b>CA:</b> Cardiac arrest
<b>OMC:</b> Outpatient medical center	<b>CPR:</b> Cardiopulmonary resuscitation
<b>AED:</b> Automated external defibrillator	<b>CAT:</b> Computed axial tomography
<b>ECG:</b> Electrocardiogram	<b>VT:</b> Ventricular tachycardia
<b>VF:</b> Ventricular fibrillation	<b>CCU:</b> Coronary care unit
<b>AMI:</b> Acute myocardial infarction	

### BACKGROUND

The successful rescue of those who suffered a cardiac arrest (CA) in the public highway can only be achieved with a quick attention and mainly with early defibrillation.

The community training in cardiopulmonary resuscitation and the public access to an automated external defibrillator (AED) save lives and avoid disabling neurological sequelae.

In this presentation, a case of CA in a very busy area of the city of Buenos Aires, the prehospital attention with graphical registers of the event, its referral and the further treatment in another center are described. Also, a detailed discussion is presented and the importance of the implementation of polices of public access defibrillation is highlighted.

### CINICAL CASE

A male adult fell unconscious on the public highway, in a very busy area of the city of Buenos Aires, so those persons passing through there called an outpatient medical center (OMC) situated in the same block, which has an AED. The approximate time delay

from the call until the arrival of the medical staff was less than 2 minutes. Once they arrived, they found a patient who had gradual fall with no trauma or abnormal movements, according to what witnesses referred.

At the moment of the examination, the patient is unresponsive, not breathing and no pulse. Basic manoeuvres of cardiopulmonary resuscitation (CPR) by two operators are performed. Doctors asked for an AED, which arrived during the third external cardiac massage (ECM). The equipment is connected, and rhythm liable to defibrillation is detected, so the shock is performed, as it is shown in Figure 1.

ECM is restarted, and carotid pulse is verified. The patient is referred to the shock room of the OMC.

*Vital signs once at the shock room:* blood pressure 120/60 mm Hg, heart rate 100 beats per minute and saturation of O<sub>2</sub> 94%. He presents generalized tonic-clonic seizures, so 4 mg of lorazepam intravenous bolus is administered. He evolved with subintractant episodes which required prolonged sedation, so he initially received ventilatory support with Ambu and then mechanical ventilation (MV).

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**Admission ECG:** sinus rhythm and ST elevation from V2 to V4, compatible with hyperacute anteroseptal myocardial infarction.

Intravenous ASA is administered and expansion with crystalloids is performed due to arterial hypotension and inotropics are administered. Once he was hemodynamically stabilized, he was referred to another center (after about 90 minutes from the beginning of the symptoms). He was admitted to the CCU in MV, with requirement of inotropics and under sedation.

**Physical examination in MV:** crepitant rales in both lung fields. Normal peripheral perfusion. Non-

reactive discoric pupils (sedation).

**Brain CAT:** mesencephalic hypodensity compatible with trunk ischemia.

**ECG:** ST elevation in anterior area compatible with hyperacute AMI. Doctors deduced that the CA was secondary to an AMI.

**Coronary angiography:** acute occlusion of the middle third of the anterior descending artery.

An angioplasty in the anterior descending artery with stent implantation is performed, with no “re-reflow”.

At CCU the patient received Swan-Ganz compatible with heart failure (wedge 20 mm Hg, cardiac index



**Fig. 1.** From the ignition of the AED until the shock.

**Fig. 2.** From the shock until the referral to the outpatient medical center.



2.5 L/min and moderate stroke work index, 30 G/m<sup>2</sup>), with no signs of clinical or metabolic hypoperfusion (lactic acid: 1.6 mM/L). He improves favourably.

*Echocardiogram:* extensive anteromedial, anteroapical, middle septal, apical and inferoapical akinesia.

The third day of MV he could be assessed neurologically, with ad integrum restitution (discoria was fixed, secondary to cataract surgery); extubation could be performed the eighth day due to Citrobacter aspiration pneumonia, so antibiotics were administered.

Nowadays, he is being monitored in an outpatient way with no heart failure or neurological disorders. Brain magnetic resonance: normal.

*Current treatment:* enalapril 20 mg; atenolol 25 mg; rosuvastatin 20 mg; spinorolactone 25 mg; aspirin 81 mg and varenicline 2 mg.

*Ergometry:* normal to 750 kgm.

## DISCUSSION

### Prehospital cardiac arrest

Cardiovascular disease is the main cause of death in Argentina and in most of underdeveloped countries. (1)

According to the estimates, 25% of the persons who may suffer an AMI will die due to the event. More than half of them will die before reaching a hospital. Most of these deaths would be consequence of fatal arrhythmias, as ventricular tachycardia (VT) or ventricular fibrillation (VF), and not due to the extension of myocardial damage. This led Claude Beck to coin in 1956 the phrase "hearts too healthy to die".

The only way to achieve an acceptable survival is by cardiopulmonary resuscitation manoeuvres as early as possible, mainly external cardiac massage and fast defibrillation.

The American Heart Association developed the "Chain of Survival", stating the actions that should be carried out (links of the chain) in view of a CA in order to achieve the objective of the CPR. The links are: 1) early access to emergencies areas, 2) early CPR, 3) early defibrillation and 4) advanced support (drug infusion, advanced treatment of the airway, etc)

The success rates in prehospital CA due to VF in large cities as Chicago or New York are disappointing: less than 2% of the victims return to spontaneous circulation with no disabling neurological sequelae. The delay in defibrillation in those cities is greater than 20 minutes.

However, in other places, as airports or casinos, elevated survival rates in patients who suffer a CA due to VF have been achieved, perhaps associated with the quick attention and mainly with early defibrillation. (2, 3)

In 2002, Weisfeldt et al. described a model of three phases for those victims of CA due to VF: a) electric phase, the first 4 minutes, where defibrillation is the most important manoeuvre, b) circulatory

phase, between 4 and 10 minutes after started VF, where the circulatory support, by ECM is the main therapeutics and c) metabolic phase, after 10 minutes, where the damage lesion-reperfusion predominates and the application of other therapies (hypothermia, drugs, etc) is necessary. The probability of a successful defibrillation decreases with the delay time from the beginning of the CA and the defibrillation. The VF tends to become asystole within minutes. That is why the greater parameter of success in CPR is the delay time in performing electric defibrillation. (5)

Training in the use of manual defibrillators requires knowledge and skills that only few professionals own.

AED are small, compact equipments designed to be used by trained persons, to be applied to an unconscious person, no breathing and with no circulation signs (cough, movements) for more than 10 seconds. Once the sticky pads are situated in the chest of the victim, the DEA determines if the shock is indicated, guiding the operator by voice instructions.

In this occasion Philips Hearstat FR2+® AED was used, which needs biphasic energy (truncated exponential) scheduled for an initial shock of 150 joules.

In this particular case, the presence of an AED and trained staff near the scene of the CA were fundamental for the patient survival.

The first link of the chain of survival, early access, was done correctly: less than 2 minutes from the call until the arrival of the staff trained in CPR. The second link was started immediately (early CPR) establishing appropriated chest compressions.

As the CA was seen and took less than 5 minutes (in the electric phase of CA), the AED was connected to the patient seeing rhythm liable to defibrillation (VF), so the equipment asks to pulse the defibrillation key (third link of the chain of survival), which was successful.

We think that this is a paradigmatic case which confirms that only with an adequate training program in CPR manoeuvres to professionals and laymen and the distribution of AED in strategic places (Public Access to Defibrillation) we can avoid "hearts too healthy to die".

### Public access to defibrillation

In Argentina there is no national law that promotes the need of training in basic manoeuvres of lifesaving and CPR, or the provision of AEDs in strategic places despite having submitted several projects (supported by different scientific societies) and in several instances (Chamber of Deputies of the Nation, among others).

Recently, in December 2010, the Legislature of Buenos Aires sanctioned into law (3665) the regulation of lifesaving within the local scope. Such law is an interesting step towards a more comprehensive one, national.

In our region, countries as Uruguay (law 18360 of

2008) and Brazil have made significant progress in its legislation.

Uruguay officially constituted its National Board of Resuscitation linked with the Ministry of Health after having enacted the national law of public access defibrillation. Thanks to that, several victims of prehospital CA have been successfully resuscitated (one of them in a ship of an important passenger transport company that links Argentina and Uruguay) and probably they would have died if there was no public access to defibrillation. Also, some states of Brazil (federal country with state legislatures like ours) had implemented policies of public access defibrillation.

The action of a community trained in basic CPR and automated defibrillation and the intervention of health systems supported by a consistent legislation will determine the possibility of an adequate survival and also allow mitigating the consequences that are caused by emergencies in general.

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## RESUMEN

### Paro cardiorrespiratorio prehospitalario. Desfibrilación de acceso público

#### Introducción

La enfermedad cardiovascular es la principal causa de muerte en países de concentración urbana como el nuestro. La mayoría de esas muertes se producirán en el ámbito

prehospitalario y sólo una rápida respuesta con maniobras de resucitación cardiopulmonar y desfibrilación precoz puede lograr una sobrevida aceptable. En esta presentación se describe el caso de un individuo que sufrió un paro cardiorrespiratorio mientras circulaba por la vía pública y que fue rescatado exitosamente gracias a la desfibrilación precoz realizada con un desfibrilador externo automático. Se incluyen los registros gráficos del evento y se enfatizan consideraciones sobre la importancia del concepto de acceso público a la desfibrilación.

**Palabras clave >** Resucitación cardiopulmonar - Desfibrilación electrónica - Paro cardíaco

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## BIBLIOGRAPHY

1. Writing Group Members, Lloyd-Jones D, Adams RJ, Brown TM, Carnethon M, Dai S, De Simone G, et al; American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics 2010 update: a report from the American Heart Association. *Circulation* 2010;121:e46-e215.
2. Caffrey SL, Willoughby PJ, Pepe PE, Becker LB. Public use of automated external defibrillators. *N Engl J Med* 2002;347:1242-7.
3. Weaver WD, Peberdy MA. Defibrillators in public places one step closer to home. *N Engl J Med* 2002;347:1223-4.
4. Weisfeldt ML, Becker LB. Resuscitation after cardiac arrest: a 3-phase time-sensitive model. *JAMA* 2002;288:3035-8.
5. Field JM, Hazinski MF, Sayre MR, Chameides L, Schexnayder SM, Hemphill R, Part 1: executive summary: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation* 2010;122(18 Suppl 3):S640-56.

#### Conflict of interest statement

Authors declare no conflict of interest.