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Short communication

Automated defibrillation performed by emergency medical technicians: the Madrid experience

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1. Introduction

The municipal emergency and rescue care service of Madrid responds to out-of-hospital emergencies in the city of Madrid, with a population of more than 3 million people. There is a two-tier system; basic life support (BLS) ambulances, staffed by two emergency medical technicians (EMT) provide basic life support skills and collaboration in advanced life support situations, and advanced life support (ALS) ambulances staffed by a physician and a nurse trained in the full range of prehospital advanced life support procedures, together with an EMT.

In adults the commonest primary arrhythmia at the onset of out-of-hospital cardiac arrest is ventricular fibrillation (VF) [1]. Electrical defibrillation (DF) is the single most important therapy for the treatment of ventricular fibrillation, and early defibrillation is an intermediate link between basic and advanced life support within the chain of survival (early access, early CPR, early defibrillation, early advanced care) [2]. The need for early defibrillation is clear and should have the highest priority. Moreover, the time interval between the onset of ventricular fibrillation and the delivery of the first shock is the main determinant of survival [3,4]. Until recently, defibrillation was only performed in Madrid by physicians and nurses in the advanced life support ambulances. However, in 25% of cardiac arrests a BLS ambulance provides the first response due to incorrect initial information and proximity to the victim. They continue CPR until the arrival of ALS rescuers. To achieve the goal of early defibrillation by decreasing the interval between cardiac arrest and the first shock, BLS ambulances [5] which may respond to a cardiac arrest now carry an automated external defibrillator [4,6,7] with personnel trained and permitted to use it [2,8,7].

2. Objective

To improve the treatment of patients in cardiac arrest with ventricular fibrillation or pulseless ventricular tachycardia (VT) by allowing first responders in a BLS ambulance, crewed by ambulance technicians (EMT) to use automated external defibrillators (AED), thus decreasing the interval between the cardiac arrest and the first defibrillation.

3. Subjects and methods

Patients were eligible to be included in the study if they were adults, had a prehospital cardiac arrest with VF or VT as a primary arrhythmia, and received CPR from our service between 1 July 1997 and 30 June 1998.

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The study was developed following the ILCOR recommendations [9]. The implementation of the study involved the following steps:

1. Development of an algorithm applicable by an EMT for the treatment of cardiac arrest, using an AED (Fig. 1).
2. Incorporation of AED use by EMTs in our service.
3. Compulsory previous qualification through a specific training program [10] to 85/185 volunteer EMTs. This involved running four nine hour courses each of which include the following:
   - An initial test due to evaluate previous knowledge.
   - Revision of basic and instrumental CPR skills.
   - Heart anatomy and physiology theory.
   - Ventricular fibrillation and cardiac defibrillation theory.
   - Description, management, functioning and maintenance of the AED device.
   - Introduction of the cardiac arrest treatment algorithm, using an AED, simulation of case, including basic and instrumental CPR skills with the use of an AED.
   - Final test due to evaluate the knowledge and practical skills acquired during the course.
   - Practical evaluation.
   - Management of AED training Certificate.
4. The use of two automated defibrillators, without manual override option, (Life-Pack 500™ by Physio-Control) with a recording facility, to save data on the pre- and post-defibrillation rhythms and the event audio.
5. Elaboration of a multimedia data base, with data being downloaded for analysis whenever an AED is used
6. Design and performance of a computerised (Utstein template) data base [11] using information from the AED, the ambulance report form, and the hospital records. The analysis and statistical processing of this data base was developed using the RSIGMA program. The analysed variables have been the following:
   - Time interval between cardiac arrest and the first defibrillation.
   - Number of patients who were alive on arrival at hospital.
   - Number of patients discharged from hospital and their category of cerebral and overall function according to the Glasgow-Pittsburgh score.
7. Medical supervision during the whole study. Throughout, the programme has ensured that in all the cases that AED was used there has been medical supervision, clinical audit and critical evaluation.

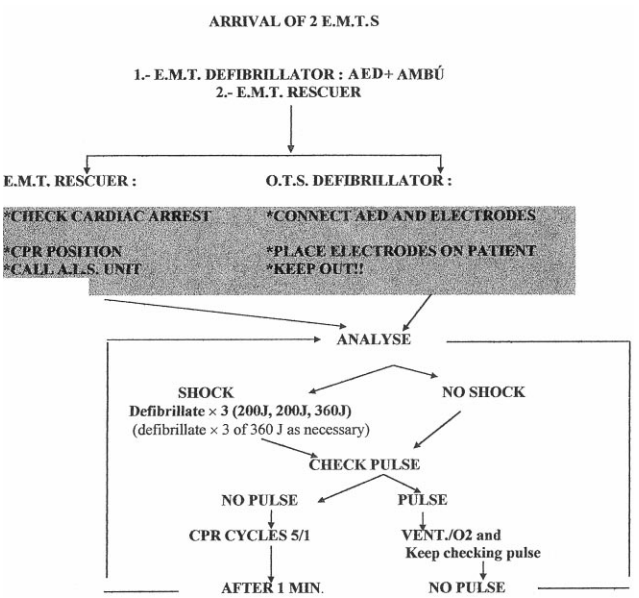

Fig. 1. Automated defibrillation performed by EMT in ABLS ambulence.

4. Results

During the entire study period, 160 patients were treated for cardiac arrest. Three groups have been analysed:

Group 1: Cardiac arrest attended first by a BLS ambulance with an AED and by an ALS ambulance afterwards.

Group 2: Cardiac arrest attended first by a BLS ambulance without an AED and by an ALS ambulance afterwards.

Group 3: Cardiac arrest attended first by an ALS ambulance.

Of the 160 patients, 84 (52.5%) had an initial rhythm suitable for defibrillation and in five an AED was used. In the remaining 76 patients an AED was used in seven.

The mean time between cardiac arrest and the first shock was 6.8 ± 1.92 min for group 1, (range

Table 1

	Group 1	Group 2	Group 3
Patients with an initial defibrillatable rhythm	5	15	64
Admitted alive to hospital	4	10	39
Discharged alive from hospital	2	6	24

4–9 min 95% confidence limits 5.1–8.5), for group 2 18.9 ± 5.34 min (range 12–28, 95% CI 16–21.8) and for group 3 11.3 ± 4.72 min (range 0–21, 95% CI 10.1–12.5)

Table 1 details the course of the patients admitted to hospital.

A total of 32 patients were discharged from hospital (38.1%). The patients who were discharged from hospital with a score of 1 or 2 of cerebral and overall function according to the Glasgow–Pittsburgh Categories were distributed as follows: group 1, 2/2 (100% of those who were alive on arrival at hospital for this group); in group 2, 3/6 (50%); and in group 3, 13/24 (54.2%).

5. Conclusion

This study shows that the use of external automated defibrillators by properly trained and supervised emergency medical technicians [8] decreases the time interval between cardiac arrest and first defibrillation, improving the survival and prognosis of those patients with out-of-hospital cardiac arrest [3,4]. The inclusion of AEDs has been well accepted by all those who were involved in the study. This aspect, together with the positive results and the absence of mistakes in the use of AED, has facilitated the incorporation of these devices in our service.

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