

Review Article

Bystander CPR: The Role Play of the First Ring of the Chain of Survival

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Submitted: 14 March 2017

Accepted: 11 May 2017

Published: 15 May 2017

ISSN: 2379-0547

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Keywords

- Cardiopulmonary arrest
- Cardiopulmonary resuscitation
- Bystander
- Chain of survival
- Emergency medical service

Abstract

Introduction: Cardiac arrest represents one of the leading causes of death. Often, the principal aetiology is a cardiovascular disease in adults, while trauma is the preponderant cause in teenagers. Cardiac arrest is a time-dependent disease, where the period of time between the event and the beginning of an irreversible neurological damage is limited. In fact the neurons suffer damage as after six minutes of cardiac arrest. Emergency systems have an increasingly rapid response due to the development of health care processes, but in some places, especially rural areas, the period between the start of cardiac arrest and the arrival of the emergency team is extended beyond the eight minutes.

The role of the bystander thus becomes fundamental for the application of the first ring of the "chain of survival", since the early application of cardiopulmonary resuscitation can prolong the period of defibrillation and ensure perfusion to the rest of the body, in particular to heart and brain.

Material and methods: A literature search was conducted on the platforms of Pubmed and CINAHL. The aim is to identify whether or not the crucial role of bystander CPR in terms of medium and long-term survival.

Discussion: The role of the bystander is fundamental. Inside the bystander CPR, a large representation is given by a healthcare professional (nurse and doctor) running a primary aid and CPR to an unknown victim in a public place. A second representation is given by lay people who followed the teaching courses to learn how to perform cardiopulmonary resuscitation and early defibrillation. Within the group of lay people has been noticed poorer survival in victims subjected to bystander CPR from their parents.

INTRODUCTION

The sudden cardiac arrest is one of the leading causes of disability worldwide²

In case of cardiac arrest, neurons suffer damage after 4 – 6 min of hypoxia [17]. From the European Guidelines of Resuscitation 2015, the out-of-hospital cardiac arrest (OHCA) has an incidence of 38 per 100 000 people, with a cardiac aetiology around 40% in a population under 75 years old, while patient lower than 35 years old has a traumatic or non-cardiac aetiology [7].

Cardiac arrest is defined, as Utstein-style, "the cessation of cardiac mechanical activity, confirmed by the absence of a detectable pulse, unresponsiveness and apnoea (or agonal respirations)" [19]. On the initial heart-rhythm analysis, about 25–50% of SCA victims have ventricular fibrillation (VF), but when the AED is soon applied the VF's proportion increases until 76% (ERC parte uno). For successful resuscitation, it's important to apply the chain of survival that consists in:

- Early recognition and call for help
- Early bystander CPR
- Early defibrillation
- Early advanced life support and standardised post-resuscitation care [1-7].

As affirmed in the European Guidelines for Resuscitation, the time between emergency call and emergency medical service (EMS) arrival is 5-8 min, with the first shock in 8-11 min [7].

In this time, the victim's survival depends on bystanders, who if they do an immediate initiation of CPR can quadruple survival after cardiac arrest. Another article demonstrates that the ALS response time exceeds 8 min [3].

Basic Life Support (BLS) is established that bystander CPR is critical to survival in out-of-hospital cardiac arrests; in fact, from 2011 in US schools, American Heart Association advocated resuscitation training to improve survival worldwide by increasing the bystander resuscitation rate [1-7].

The role of bystanders results being fundamental for survival of a victim of out-of-hospital cardiac arrest (OHCA) in more articles.

MATERIAL AND METHOD

A literature review was conducted to verify the role of bystanders in OHCA and CPR. The aim is to confirm the better survival in victims who have received CPR by bystanders than who haven't early CPR and shocks with an AED. The search strategy was ("Bystander Effect"[Mesh]) AND "Cardiopulmonary Resuscitation"[Mesh], resulting 8 articles. The fre-word search resulted 1123 articles, in which 138 are in free text published within 5 years. Part of those is used in this article as confirmation of the content.

To pursue this aim, database of Pubmed and Cinahl were consulted, in addition of principal International Guidelines about resuscitation, in particular of American Heart Association and European Council of Resuscitation, across the ILCOR website.

From the literature review, articles about traumatic cardiac arrest and in-hospital cardiac arrest were excluded, while about population training and school's education on CPA were included. Simulating programs about improvement of lay CPR were not considered in the research.

RESULTS

From the keywords research, a total of 1127 articles were extracted: from this, the research was limited to free full text articles with a publication data not more than five years. A total of 134 articles result from the research. From the critical analysis, the articles of interest were reduced to 40 studies, in which 15 were recognized as more important to this aim.

Furthermore, in more of these articles were references to two studies more than five years of publication dates and these two articles were included in the review for importance of studying.

Some studies analysed the epidemiologic elements (eg. Age, sex, causes), while others study the bystander's role or help before EMS arrival (Table 1).

In particular the Bossaert - Van Hoeyweghen evaluated 3053 OHCA, in which 33% CPR were performed by bystanders, in particular 13% circa by lay people and family members, while 20% circa by health care workers; in their studies, where sudden infant death syndrome (SIDS) and drowning are highly represented. In public place, the principal actors of CPR are health care provider (nurse and physician) who performed external compressions in victims of trauma (eg. Hemorrhage), respiratory causes, intoxication. The study shows how the bystander CPR increase the survival in witness and non-witness cardiac arrest; furthermore no negative effects of wrong technique or not adequate CPR were demonstrated in the article [3].

The importance of teaching CPR and early defibrillation to lay people is confirmed by a study that analysed the early CPR in OHCA [11]. In fact, considering the pathophysiology of cardiac (Figure 1) arrest, if a CPR is early performed, the time to defibrillation will be prolonged. The first rhythm is frequently represented by VF, that can be corrected by a defibrillation or the

Table 2. The Rate of 30-Day Survival in Relation to the Time from Collapse to the Start of CPR.

Subgroup	No. of Patients with Data	Survival Rate According to Time from Collapse to Start of CPR*			
		0-3 min	4-8 min	9-14 min	>14 min
All patients	23,931	15.6	8.7	4.0	0.9
Age					
≤72 yr	12,169	19.2	11.0	5.6	1.5
>72 yr	10,968	10.8	6.7	2.6	0.4
Sex					
Female	6,424	12.2	7.5	4.5	1.0
Male	16,842	16.9	9.4	3.8	0.9
Cardiac cause					
Yes	16,534	16.6	9.5	4.0	0.9
No	5,979	12.9	6.5	3.8	1.0
Location of cardiac arrest					
At home	15,179	9.2	6.0	3.3	0.7
Other location	8,579	21.6	12.9	5.7	1.7
VF or VT as initial ECG rhythm					
Yes	8,213	26.4	15.6	7.9	2.7
No	13,941	4.6	3.1	1.6	0.4
Year of cardiac arrest					
1990-1995	5,068	16.3	9.6	3.5	0.7
1996-2001	6,397	11.9	6.7	3.1	0.5
2002-2007	5,605	15.2	9.9	4.8	0.8
2008-2011	6,666	17.0	8.9	4.9	2.0

* P<0.001 in all subgroups for the association between the time from collapse to the start of CPR and 30-day survival.

Table 1 Rate of 30-day survival¹¹.

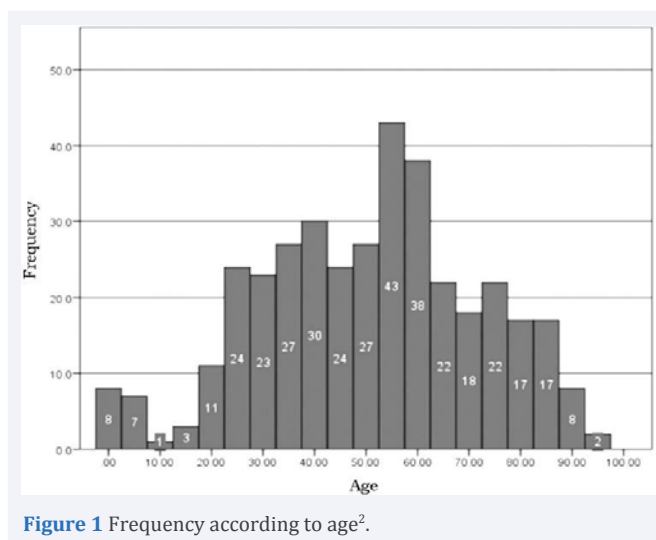


Figure 1 Frequency according to age².

time to evolve in asystole can be prolonged until the arrival of AED. In the analysis, the better outcome of OHCA is represented by an event occurred in public place, where bystanders are often younger and trained to CPR; for this reason, the public place has a better survival than who have a CPA at home [1-4,7-10].

Finally, another article analysed the effect of bystander CPR in a rapid response EMS system. A total of 298 CPA were included in the study, in which 65.4% were witness, 34.6% no-witness. The study demonstrated that VF/VT have better outcome than a non-shockable rhythm and the bystander CPR has survival rate among 20% than no-bystander CPR (9.2%). In particular 18 had a return of spontaneous circulation, of whom 72.2% survived respect the 31.6% of victims with no-bystander CPR [20].

Unfortunately, in a recent study in Northern Emirates of United Arab Emirates looks into the OHCA profile, the authors ascertain that in one year between 2014-2015, only 3.1% CPA

has a ROSC, in whom 30% has the contribution of bystander CPR, applying a public AED in 0.5% of cases.

The low rate of bystander CPR is common in more articles, in which it is a small percentage (2.3%) respect to 92.9% of witness cardiac arrest in public place [14].

DISCUSSION

As demonstrated, bystanders play a principal role in CPR during CPA. More studies show as a early CPR can improve survival and outcome in CPA victim's. The CPR performed before the EMS arrival was associated with a rate of immediate and 30-day survival more than twice as high as no CPR before EMS arrival. In fact bystander cardiopulmonary resuscitation is associated with a 23% lower mortality [4].

Inside the bystander CPR, it was found as a better survival was noticed in patients resuscitated from unknown people (lay people and health personnel) rather than by parents. The possible explanation could be attributed to the strong emotional charge of cardiopulmonary resuscitation to a loved one [13].

As reported in more studies, the hypothermia, coronary revascularization, implantable cardioverter-defibrillators and extracorporeal machine oxygenation has been improved the outcome of CPA's victims, but these interventions will not exist without an early CPR.

The technology can help the lay people to recognize and to manage a CPA: various examples are attributable to app for smarthphone, or drones project of Italian Red Cross that brings to bystander the AED, or the simple call to emergency service when a health care dispatcher teaches the CPR during the phone call [8-17].

Programs as American School Education by American Heart, Education to lay people by London Ambulance Service (LAS), European and in particular Italian Resuscitation Council education to population must be improved to teach what is the "chain of survival", how to recognise a cardiac arrest, how to do a cardiopulmonary resuscitation with application of AED, so how to save a life.

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Cite this article

Cusmà PR (2017) Bystander CPR: The Role Play of the First Ring of the Chain of Survival. *J Family Med Community Health* 4(3): 1110.