



# Influence of Basic Life Support on Donor Organs in Uncontrolled Donors After Cardiac Death

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## ABSTRACT

**Background.** The aim of this study was to determine whether the application of basic life support (BLS) in patients who have experienced cardiac arrest and are subsequently referred to as uncontrolled asystole donors has any influence on the achievement of organs for subsequent transplantation.

**Methods.** Demographic data, BLS, cause of death, emergency response times, and organ donations were collected. The analysis of quantitative variables following normal distribution is shown as mean (SD), and Student *t* distribution was used for comparison purposes. The analysis of variables that did not follow the normal distribution is shown as median (IQR), and Wilcoxon test was applied for comparison purposes.

**Results.** A total of 91 cases of possible uncontrolled donor transfers were analyzed. Basic life support was provided to 61 patients (67.7%), whereas no BLS was provided to 27 patients (23.3%). Of the group that received BLS, 39 (73.6%) were effective donors compared with the non-BLS group, in which 22 (62.9%) were effective donors ( $P = .28$ ).

**Conclusions.** We did not find an association between performing BLS compared with non-BLS and organ donation.

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**B**ASIC life support (BLS) has been shown to be useful in cardiac arrest (CA). Numerous studies have reported that patients who have experienced cardiac arrest and receive BLS correctly have a greater possibility of survival [1]. When CA occurs, it is vital that successful BLS be initiated to provide the patient with a window of opportunity for emergency services to arrive in time and initiate advanced resuscitation measures. Correct BLS provides the patient with sufficient support to maintain minimal cardiac and pulmonary perfusion [2]. Although minimal, this perfusion is sufficient to provide the necessary cardiac output before advanced resuscitation measures can be performed.

In cases where advanced life support fails to return to spontaneous circulation, the patient may be transferred to a health care facility for organ donation provided that the criteria for inclusion in uncontrolled donors after the cardiac death procedure are met [3]. The inclusion criteria are explained later in this study. These patients were transferred to the hospital under cardiopulmonary resuscitation (CPR) to validate the donor and, if

the family agreed, donate their organs. The organs extracted from these donors were the kidneys, liver, and lungs. Several studies have evaluated the influence of factors pertaining to CPR on the evolution of both donations and organs generated by it; in one of them, the response times of emergency services had no influence on the procurement of organs, but in the second, this association was present [4,5]. However, what did remain clear was that the response times of the emergency services and the treatment administered to the patient because of CA may influence the attainment of organs for transplant.

However, whether the application of BLS influences this type of procedure has not been studied. The primary outcome measure was organ donation. This study aimed to determine whether the application of BLS (bystanders, professionals, or both) to patients who have experienced CA and are

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Table 1. General data of the population.

	N	N = 91 <sup>1</sup>	Basic CPR		p-value <sup>2</sup>	
			N	Yes, N = 61 (69%) <sup>1</sup>		No, N = 27 (31%) <sup>1</sup>
<b>Age (years)</b>	91	49 [42-55]	88	49 [42-55]	48 [42-54]	0,867
<b>Gender (Male)</b>	91	79 (86.8%)	88	54 (88.5%)	22 (81.5%)	0,501
<b>Witnessed PCR</b>	90	89 (98.9%)	87	61 (100.0%)	26 (100.0%)	>0,999
<b>Witnessed by</b>	88		86			<b>0,009</b>
No sanitary witness		81 (92.0%)		58 (96.7%)	21 (80.8%)	
Non-EMS <sup>‡</sup> personnel		3 (3.4%)		2 (3.3%)	1 (3.8%)	
EMS		4 (4.5%)		0 (0.0%)	4 (15.4%)	
<b>Initial CPR rate</b>	89		86			0,084
VF/VT <sup>§</sup>		21 (23.6%)		17 (28.8%)	4 (14.8%)	
Asystole		59 (66.3%)		39 (66.1%)	17 (63.0%)	
Pea <sup>Ⓜ</sup>		3 (3.4%)		1 (1.7%)	2 (7.4%)	
Bradycardia		5 (5.6%)		2 (3.4%)	3 (11.1%)	
Unknown		1 (1.1%)		0 (0.0%)	1 (3.7%)	
<b>Etiology</b>	90		87			0.854
Medical		56 (62.2%)		40 (66.7%)	16 (59.3%)	
Trauma		6 (6.7%)		4 (6.7%)	2 (7.4%)	
Drowning		1 (1.1%)		1 (1.7%)	0 (0.0%)	
Other		1 (1.1%)		1 (1.7%)	0 (0.0%)	
Unknown		26 (28.9%)		14 (23.3%)	9 (33.3%)	
<b>Time between cardiac arrest and arrival at hospital (min)</b>	90	88 [80-105]	87	88 [79-105]	87 [81-104]	0,996
<b>Right kidney</b>	91		88			0,736
Donated		50 (54.9%)		34 (55.7%)	14 (51.9%)	
Not donated		41 (45.1%)		27 (44.3%)	13 (48.1%)	
<b>Left kidney</b>	91		88			0,846
Donated		48 (52.7%)		33 (54.1%)	14 (51.9%)	
Not donated		43 (47.3%)		28 (45.9%)	13 (48.1%)	
<b>Lungs</b>	10		9			>0,999
Donated		7 (70.0%)		5 (62.5%)	1 (100.0%)	
Not donated		3 (30.0%)		3 (37.5%)	0 (0.0%)	
<b>Liver</b>	21		19			>0,999
Donated		6 (28.6%)		3 (21.4%)	1 (20.0%)	
Not donated		15 (71.4%)		11 (78.6%)	4 (80.0%)	
<b>Cardiocompressor</b>	91		88			>0,999
Yes		88 (96.7%)		58 (95.1%)	27 (100.0%)	
No		2 (2.2%)		2 (3.3%)	0 (0.0%)	
Unknown		1 (1.1%)		1 (1.6%)	0 (0.0%)	

<sup>1</sup> Median [IQR]; n (%)<sup>2</sup> Wilcoxon rank sum test; Fisher's exact test; Pearson's Chi-squared test

‡ Emergency Medical Services

§ Ventricular Fibrillation / Ventricular Tachicardia

Ⓜ Pulseless Electrical Activity

subsequently referred to as uncontrolled donors has any influence on the achievement of organs for subsequent transplant. We compared the application of BLS in all patients in the uncontrolled donor group after the cardiac death procedure to analyze its influence on organ procurement.

## MATERIALS AND METHODS

The CORE database is a centralized registry at the national level where relevant information on donors and recipients is included. It is managed by the National Transplant Organization and all regional and hospital transplant coordination offices have access to it. The Out-of-Hospital Spanish Cardiac Arrest Registry is a European out-of-hospital cardiac arrest registry in which all cardiac arrests attended by out-of-hospital

emergency services have been included for a few years [6]. This registry has the peculiarity of being based on temporary cutoffs; that is, cardiac arrests were recorded during 3 periods: October 2013 to September 2014, April 2017 to February 2018, and 2019. The data were collected from SUMMA112 (emergency medical service of the Community of Madrid) and the Hospital Clinico San Carlos and 12 de Octubre because it is only the center that performs this procedure.

All patients included in the uncontrolled donors after cardiac death procedure were recorded during the study period. The inclusion criteria for this procedure are described in the literature [7] and are the following: age between 18 and 60 years, response time of <15 minutes, transfer time to the hospital of <120 minutes, and meeting the general conditions for organ donation. The variables collected were demographic data, BLS, cause of death (medical, trauma, drowning, unknown, or other), emergency response times (time to arrive at the

**Table 2. Result of Donation According to Basic Cardiopulmonary Resuscitation**

Variable	Effective Donors		P Value*
	Yes 55 (60%)	No 36 (40%)	
Basic life support, No. (%)			.286
Yes	39 (73.6)	22 (62.9)	
No	14 (26.4)	13 (37.1)	

\* Pearson's  $\chi^2$  test.

scene and time to arrive at the hospital), and organ donation. The analysis of quantitative variables following normal distribution is shown as mean (SD), and Student *t* test was used for comparison. The analysis of variables that did not follow the normal distribution is shown as median (IQR), and Wilcoxon test was applied for comparison. The  $\chi^2$  test was used to compare the application of BLS and procurement of organs with a 95% CI. The study received positive opinions from the ethics committee (no. 50/2021).

## RESULTS

This study included 91 patients who were transferred to hospitals as possible uncontrolled donors after a cardiac death. The mean age was 49 years (IQR, 42-55 years), and the majority were male (79 [86.8%]). The cause of CA was medical in 62.2% of the cases. The average time between the emergency call and arrival at the hospital was 88 minutes (IQR, 80-105 minutes). The initial heart rhythm on arrival at the emergency services was asystole in 66.3% of cases. CA was witnessed by others in 92% of cases. In 88 cases, transfer was performed using a mechanical cardiac compressor. The differences in these variables between the groups that did and did not receive BLS are shown in Table 1.

Basic life support was performed in 61 patients (67.7%), whereas no BLS was performed in 27 patients (23.3%). No data regarding BLS were obtained for 3 patients. Of the group that received BLS, 39 (73.6%) were effective donors compared with the non-BLS group, in which 22 (62.9%) proved to be effective donors ( $P = .28$ ) (Table 2). Analysis by organ (kidney, lung, or liver) showed no significant difference between patients who received BLS and those who did not (Table 1).

## DISCUSSION

The need for organ donation in many countries has led to the development of innovative organ donation models, including uncontrolled donors after cardiac death. Some articles have analyzed the potential of this type of donation in their territory, as well as the factors that can influence it positively or negatively [6]. The application of the BLS allows the patient to be given an opportunity to recover a spontaneous pulse or fail to enable donation in territories where the procedure is active.

Performing BLS in patients with CA is recommended by all the CPR guidelines. Undoubtedly, BLS can be effective in increasing the chance of recuperation of spontaneous circulation. The benefit of BLS in patients who do not recover a spontaneous pulse and can be transferred as uncontrolled donors

after cardiac death is unknown. According to our findings, we did not detect an association between performing BLS with reference non-BLS and organ donation. Even after carrying out a detailed analysis of donated organs (kidney, liver, and lung), we did not find an association with BLS.

Significantly, the time between CPR and hospital transfer (similar in both groups) did not seem to influence donation outcome. This finding differs from those of other studies because some authors have shown an association between the time of cardiac arrest and the results in cases of kidney graft [6].

However, the variables that come into play in deciding the possibility of an effective donor after CPR are so varied that it is highly difficult to summarize the possibility of donation or no donation down to a single point. To this end, we must add several studies in the field of donation in brain death that affirm that cardiopulmonary resuscitation does not appear to affect kidney grafts in cases of donors in brain death [8,9].

## DATA AVAILABILITY

The data that has been used is confidential.

## DISCLOSURE

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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