

# THE INFLUENCE OF INDIVIDUAL AND ENVIRONMENTAL FACTORS UPON THE OUTCOME OF THE RESUSCITATION OF CARDIAC ARREST PATIENTS

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**Abstract:** This paper describes the major findings in a descriptive study on factors that lead to an unexpected cardiac arrest in a general population served by a major public hospital and factors that influence the outcome of the cardiopulmonary resuscitation. The cases collected over a period of 2 years in the Emergency Department of “Saint Pantelimon” Hospital, were analysed. There were 164.670 presentations, 195 being patients who developed cardiac arrest and were included in the study. The return of the spontaneous circulation occurred in 40% of the cases and 11.53% of them survived to discharge. In younger patients, the outcome was poor due to the long delays in making the call for help. It was noted that none of the patients who underwent post-traumatic cardiac arrest survived. The limits of the study are primarily related to the single-centre status of the study, but the results encourage further studies.

## INTRODUCTION

Cardiac arrest is defined as a state of being in which the heart fails to contract (1); a person in cardiac arrest has no blood pressure, as there is no blood flow. Once the cardiac arrest occurs, the human body undergoes a series of physical and chemical transformations resulting in a rapid onset of both metabolic and respiratory acidosis, which leads to irreversible death. Although the cardiopulmonary resuscitation (CPR) attempt may be successful and the patients may have a return of the spontaneous circulation (ROSC), more than half of the survivors present different degrees of neurological injuries and less than 10% are found to recover to an optimum cerebral performance, as to be able to return to work.(2-4)

## MATERIALS AND METHODS

This is a retrospective study which refers to the resuscitation attempts taken place in the Emergency Department (ED) of the “St. Pantelimon” Hospital between the 1<sup>st</sup> of January 2011 and the 31<sup>th</sup> of December 2012. “St. Pantelimon” Hospital is a major teaching hospital serving the south-east part of Bucharest and affiliated counties. It has permanent access to high medical equipment and medication and highly trained doctors and nurses. The hospital lacks a cardiac catheterization laboratory, but due to a national strategy, any patient in need of such a procedure is taken to another hospital specially prepared for receiving these patients.

Only the cases of patients suffering cardiac arrest during their staying in the ED, prior to the hospital admission or out of hospital cardiac arrest (OHCA), their resuscitation being completed by the ED staff were included in the study.

Different parameters had been followed, such as the return of spontaneous circulation (ROSC; central pulse for at least 20 consecutively minutes after resuscitation), distance survival and the relations between demographic characteristics and the cardiac arrest event. The data was statistically analyzed using SPSS 20.0 and Microsoft Excel.

## RESULTS AND DISCUSSIONS

There were 164.670 emergencies attended by the ED staff in the mentioned period of time (82.288 in 2011 and 82.382 in 2012). There were found to meet the inclusion criteria 195 patients suffering cardiac arrest.

The incidence of cardiac arrest as a medical emergency was found to be 118 cases per 100.000 for the population served by the “Sf. Pantelimon” Hospital. The population of District 2, the region where the “Sf. Pantelimon” Hospital lies, has a population of about 360.000 inhabitants, but the hospital serves a much larger population, augmented by the counties Ilfov, Călărași and other regions with lower medical facilities.

Regarding the sudden death, the international literature mentions a wide range for the incidence, between 36 and 128 cases per 100.000 inhabitants per year.(5) Accurate data cannot be known as internationally accepted methods of death certification do not include a specific category for sudden cardiac death.(6)

From a total number of 195 cases, 40% – 78 patients – had shown the return of spontaneous circulation, therefore the resuscitation manoeuvres were successful, the cardiac arrest being considered resuscitable. Out of these patients, 9 were discharged alive (11.53%) and 69 patients died in hospital during the post-resuscitation care.

A rate of 40% ROSC, and a survival rate at discharge of 11.53% are results compatible with the international literature. The most well-established resuscitation reporting systems, such as those of the United States, reported ROSC for 44% of the patients which underwent resuscitation manoeuvres, both at out-of-hospital resuscitations (OHCA), and at intra-hospital ones (IHCA), with a discharge survival rate of 17%.(7)

Other reports indicate other figures, higher for intra-hospital resuscitations, and lower for out-of-hospital cases. A different situation was reported by a department of internal medicine in Canada, with a survival rate at discharge of

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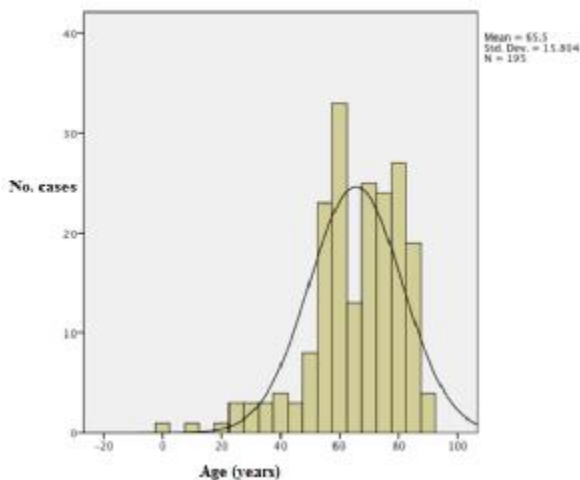
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2.4%.(8)

The previous resuscitation related data communicated by the “Saint Pantelimon” emergency team showed up to 14.1% survival at discharge for cardio-pulmonary arrests between 2001 and 2005.(9) The slight decrease in performance indicated by figures can be explained by the increasing numbers of medical interventions outside hospital, in connection with the developing of the mobile emergency system.

In the study group, there is a distribution on age groups with larger numbers in the 7<sup>th</sup> decade. The mean age where cardiac arrest happened is 65.5 years old, and the median is of 68 years old, as seen in figure no. 1.

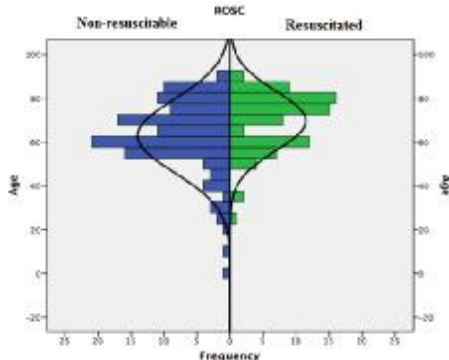
**Figure no. 1. Age of onset of the cardiac arrest**



These data are similar to those of the international literature; a prospective study on a population of 660.486 people in Oregon, USA, presented over one year a rate of total deaths of 153 per 100.000 people, of which 53 per 100.000 people were sudden deaths (353 cases). The median age was 69 years old.(10)

Analyzing age as a factor that influences the success rate of resuscitation, we observe that successful resuscitation is mostly happening at patients that suffer cardiac arrest at older ages ( $p < 0.01$ ). The connection between age of the patients and the return of spontaneous circulation is shown in the graphic model seen in figure no. 2.

**Figure no. 2. Frequency of ROSC in resuscitated and non-resuscitated cardiac arrest**



Even though age influences the return of spontaneous circulation in the study group, the age does not influence the survival rate at distance ( $p = 0.97$ ).

The number of men which suffer cardiac arrest in

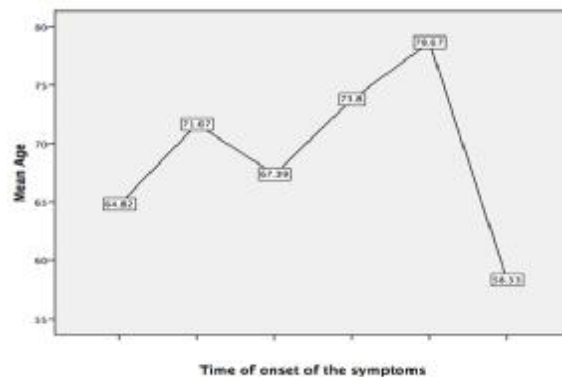
emergencies is higher, this observation corresponding to international data that indicates the male gender as a risk factor for sudden cardiac death.(11) Other studies also indicate male predominance of cardiac arrests in emergencies, in both general studies (57% of male patients according to data on 14.720 patients of the US National Registry of Cardio-Pulmonary Arrests (12), and studies focused on young adults (predominance of males both in cardiac arrests of cardiac presumed causes and of non-cardiac presume causes) (13), and our findings support this data. The males are also predominant in cases of post-traumatic cardiac arrests.(14)

The gender, however, for our study, neither constitutes a factor for predicting the return of spontaneous circulation ( $p > 0.05$ ), nor for distance survival, once the heart was restarted.

One particular aspect of the group is the late moment they chose to call for emergency assistance. Over 40% of patients included in the study have called for emergency assistance or arrived at emergency rooms long after the first signs which have preceded the cardiac arrest. This does not seem to influence the immediate result of resuscitation (there are no significant statistical differences between the moment when the emergency installed and the return of spontaneous circulation), but it does represent a factor for survival (mantel-Cox coefficient  $p = 0.03$ ). We note that the patients which called emergency services sooner after the onset of the symptoms had a better survival rate post-resuscitation.

Another observation on the group is the positive correlation between the age of the patients and the time delay since the onset of the symptoms (Kendall Test  $p = 0.026$ , Spearman Test  $p = 0.031$ ); this relation is showed in figure no. 3.

**Figure no. 3. Time of onset of symptoms regarding the age of patients**



The main complaint for addressing to the emergency room was shortness of breath, followed by chest pain. The patients were found mainly to have cardiac arrest of cardiac origin (33.16%). For a large number of patients (21.58%) the cause of the arrest could not be determined in the Emergency Room, as no history or relevant event information could be gathered. The cause of the arrest was found to be one factor to influence the outcome of the resuscitation ( $p = 0.023$ ). All post-traumatic cardiac arrests were failed resuscitations. It is known that mortality in trauma-related cardiac arrest is rising close to 100%, still there are cases reported of discharged alive patients, concluding that resuscitation in post-traumatic cardiac arrests is not futile.(15)

The first monitored rhythm was asystole, followed by pulseless electrical activity. The rhythms without indication of an electric shock represent 89.74% of the cases. For this group, a correlation between the first monitored rhythm and the outcome of the resuscitation was not found, contrary to

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international literature, were we learn that shockable rhythms are associated with better outcomes in resuscitation.(16-18)

A total of 9 patients (11.53%) in the study group survived to discharge. For the evaluation of the neurologic status of these patients, the cerebral performance category (CPC) scale had been used. 7 of the patients were discharged with a maximum CPC of 1 and 2 patients with a CPC of 2, these being good results among resuscitated patients, as international literature mentions cognitive impairment for up to 50% of cardiac arrest survivors and the preserved work ability for up to 13% of the survivors. As a factor that benefits the CPC, the therapeutic hypothermia was found to be important.(19)

In our study, due to the low number of cases, no factors that influence the CPC of cardiac arrest could be mentioned. The limitations of the study, mainly consists in the fact that it is a single center study.

### CONCLUSIONS

The unexpected cardiac arrest is rightfully considered to be a dramatic event that ends the life of the vast majority of the patients. Still, every study conducted, including ours, proves that there is hope, even if for a small number of patients, to survive and to survive with preserved neurological functions.

As for the population represented by our single-centre study, we noted that younger patients should learn to ask for help earlier, as they tend to disregard symptoms such as shortness of breath, chest pain and get help only when it might be too late.

The leading cause of arrest for our group is myocardial infarction.

The first monitored rhythm does not influence the return of spontaneous circulation, nor survival for our group.

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