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Retrospective Evaluation of Patients Undergoing Cardiopulmonary Resuscitation in the Emergency Department

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ABSTRACT

Objective: In this study, we aimed to investigate demographic data of patients who were arrested in an emergency department and outside the hospital, who died despite effective cardiopulmonary resuscitation (CPR), how they were admitted to the emergency department, blood parameters, additional diseases, and duration of CPR.

Methods: Two hundred two patients whose complete records can be accessed were included in the study. Demographic data of patients, emergency department arrival patterns, vital signs, additional diseases, blood gas pH, lactate, base minus values, CPR duration and adrenaline doses used in CPR were recorded.

Results: Two hundred twenty-one (59.90%) of the patients were male and 81 (40.09%) were female. Of the men, 69 (57.02%) were in the emergency department and 52 (42.97%) were outside the hospital. Fifty (61.72%) of the women were arrested in the emergency department and 31 (32.27%) were arrested outside the hospital. The average age of men was 70 and the average age of women was 80. In the group with non-hospital arrest, there was a significant difference between base minus, lactate and pH values in arterial blood gas compared to the group with in-hospital arrest.

Conclusion: Cardiopulmonary arrest is a very important health problem that is common in emergency departments and has a high rate of mortality. The society should be made aware of early diagnosis, timely and correct intervention, and rapid transfer of arrested cases outside the hospital. Advanced age, concomitant comorbid diseases, and prolonged CPR times are directly associated with mortality.

Keywords: Cardiopulmonary arrest, mortality, blood gas

INTRODUCTION

A sudden loss of consciousness with the termination of hemodynamics due to the cessation of electrical activity in the heart and the subsequent deterioration of cerebral perfusion is called cardiopulmonary arrest (1). 56-80% of arrest cases are of cardiac origin (2). Adult patients often have an underlying ischemic heart disease. A third of patients with acute myocardial infarction die within the first hour of reaching the hospital.

Generally, fibrillated rhythms are responsible for most of these deaths (ventricular fibrillation or pulseless ventricular tachycardia)

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(3). Pulseless electrical activity and asystolic rhythms are the most common in hospital arrests (4).

Causes of non-cardiac arrest can often be considered as non-traumatic bleeding, pulmonary thromboembolism, malignancy, intracranial pathologies, trauma, intoxication, and drowning in water (5).

In non-hospital arrest cases, the prognosis is poor and survival remains 3-7% despite effective cardiopulmonary resuscitation (CPR). 69% of these patients are male (6). In patients admitted to the emergency department, cardiopulmonary arrest is a condition with high mortality that can occur at any time. If there is hypotension, tachycardia, tachypnea, mental status changes, decreased urine output and accompanying laboratory abnormalities (hypoxia, acidosis, hyponatremia, hyperkalaemia, increased creatinine) in the patient who is followed up in the emergency room, the possibility of arrest is high. In hospital arrests, non-cardiac pathophysiological processes continue and eventually cardiac arrest develops (7). Mortality is quite high in both out-of-hospital and in-hospital arrests, even with timely and effective CPR (7).

In this study, we aimed to investigate the demographic data, forms of admission to the emergency room, blood parameters, comorbidities and CPR times of patients who were arrested in an education and research hospital emergency room or who were arrested outside the hospital and were brought to the emergency department and died despite effective CPR.

METHODS

For this retrospectively planned study, approval was obtained from the Ethics Board from a Şişli Hamidiye Etfal Training and Research Hospital (approval number: 2691, date: 25.02.2020). Patient consent was not obtained due to the fact that the study was retrospective, that there were patients with exitus, and that it was conducted through laboratory data. After the approval of the ethics committee, patients who were brought to a Training and Research Hospital, Clinic of Emergency Medicine with cardiac arrest or who developed cardiac arrest in the emergency department, who could not respond despite the current CPR protocol, and died between 01.06.2018 and 01.06.2019 were scanned retrospectively. In accordance with the current advanced life support protocols, the information of the cases undergoing CPR was obtained from the emergency service referral forms, ambulance case forms, emergency service and hospital records. A total of 202 patients whose information was fully accessible were included in the study. Patients were divided into two groups as those who were arrested inside the emergency room and outside the emergency room. Patients who were arrested outside the emergency department were also examined in two subgroups as those who applied to the emergency room with their own vehicles and those who came by ambulance. Demographic data of patients, emergency department arrival patterns, vital signs, additional diseases, blood gas pH, lactate, base minus values, CPR duration and adrenaline doses used in CPR were recorded.

Statistical Analysis

The SPSS for Windows, Version 22 (IBM, Armonk, NY, USA) was used for statistical analysis. Kolmogorov-Smirnov test was used for normality of variables. Mean ± standard deviation (SD) was used for parameters with a normal distribution, and median [interquartile range (IQR)] was used for parameters that did not match the normal distribution. Student's t-test was used for parameters with normal distribution. Those who did not have a normal distribution were evaluated by the Mann-Whitney U test. Pearson's correlation coefficients were calculated for normally distributed parameters. Spearman correlation coefficients were calculated for parameters that were not normally distributed. A p-value of <0.05 was considered statistically significant. In the descriptive statistics of the data, mean ± SD, median lowest, highest, frequency and ratio values were used.

RESULTS

Two hundred two patients who came to the emergency medicine clinic as an outpatient arrest or who died while being followed in the emergency department and died despite effective CPR were included in the study. One hundred twenty-one of these patients (59.90%) were male and 81 (40.09%) were female. Sixty-nine (57.02%) of the men were arrested in the emergency room and 52 (42.97%) outside the hospital. Fifty (61.72%) of the women were arrested in the emergency room and 31 (32.27%) outside the hospital (Table 1).

Table 1. Characteristics of routine blood parameters according to where patient groups are arrested

	Median (IQR)			
Features	**In-hospital (n=119)**	**Out-of-hospital (n=83)**	**All patients (n=202)**	**p**
Age, median (IQR), time, year	77.0 (64.0-85.0), 19-98	73.0 (56.0-84.0), 19-94	71 (63-84), 19-98	0.347
Gender, male/female	69/50	52/31	121/81	0.507
Lactate	4.4 (2.6-7.1)	10.9 (8.0-14.0)	7.0 (3.5-11.6)	<0.001*
pH	7.03 (6.92-7.18)	7.31 (7.2-7.4)	7.2 (7.05-7.379)	<0.001*
K, mmol/L	5.2 (4.2-6.3)	4.5 (3.8-5.4)	4.7 (4.0-5.89)	<0.001*
BD, mmol/L	-12.1 [-18.8-(-)8.8]	-6.8 [-12.4-(-2.5)]	-9.84 (-14.5-4.0)	<0.001*
CPR duration,min	35.0 (30.0-50.0)	40.0 (30.0-50.0)	40.0 (30.0-50.0)	0.215

CPR: cardiopulmonary resuscitation, IQR: interquartile range, K: potassium, BD: base deficit

In the group with non-hospital arrest, there was a significant difference between base minus, lactate and pH values in arterial blood gas compared to the group with in-hospital arrest (Table 1).

Forty-five (54.21%) of the cases arrested outside the hospital were admitted to the emergency department with their own vehicles, while 38 (45.78%) were brought to the emergency department with 112 ambulances (Table 2).

The average age of men was 70 and the average age of women was 80. Among the cases of arrest outside the hospital, the average age of those who came by ambulance was 73, and the average age of those who came by their own vehicle was 67. The average age of the emergency room arrest cases was 77 (Table 2).

Basic demographic characteristics and additional diseases of patients with in-hospital arrest and patients with out-of-hospital arrest are summarized in Table 2. No significant differences were found between the two groups between age, sex, and duration of CPR. P-values were p=0.347, p male=0.140, female: p=0.923, p=0.215, respectively.

The most common accompanying disease was ischemic heart disease (66.60%) in the group with in-hospital arrest, and systemic hypertension in the group with out-of-hospital arrest (48.20%).

In addition, the relationship between blood gas parameters and CPR durations is summarized in Table 3.

DISCUSSION

Sudden cardiac death, which occurs as a result of cardiopulmonary arrest, especially outside the hospital, is a significant public health problem and is one of the leading causes of death near almost the entire world. Despite rapid and effective cardioplumoner resuscitation, both in and out of hospital, there is a high rate of mortality. The mortality rate in non-hospital arrests is above 90%, while in hospital arrests this rate ranges from 13-85% (8). Therefore, the community needs to be educated and aware about recognizing cardiac arrest and providing basic life support. In this study, we aimed to define the general characteristics of cardiopulmonary arrest cases with mortal observation in the emergency department.

Wallace et al. (9) found that 54.50% of the patients were male in their study on 4,789 cases who underwent CPR. Khan et al. (10) reported that 60% of the cases were male. A higher rate of cardiac

Table 2. Basic demographic and additional diseases of patient groups

	Median (IQR)				
Features	In-hospital (n=119)	Out-of-hospital (n=83)		All patients (n=202)	p
		Ambulance	Own vehicle		
Age, median (IQR), time, year	77.0 (64.0-85.0), 19-98	73.0 (56.0-84.0), 19-94	-	71 (63-84), 19-98	0.347
Male	76 (62.5-84)	73 (28)	67 (25)	70 (30)	0.140
Famele	80 (66.5-85)	80 (16)	81 (15)	80 (16)	0.923
Gender, male/female	69/50	49/30	3/1	121/81	0.507
Co-morbidity	-	-	-	-	-
Hypertension, (n, %)	15 (51.7%)	13 (44.8%)	1 (3.4%)	29	-
Diabetes mellitus, (n, %)	7 (50%)	7 (50%)	0 (0%)	14	-
Ischemic heart disease, (n, %)	20 (66.6%)	10 (33.3%)	0	30	-
Chronic kidney disease, (n, %)	8 (80%)	2 (20%)	0	10	-
Cancer, (n, %)	17 (89.4%)	2 (10.5%)	0	19	-
Cerebrovascular accident, (n, %)	7 (77.7%)	1 (11.1%)	1	9	-
Chronic obstructive pulmonary disease, (n, %)	8 (80%)	2 (620%)	0	10	-
Other, (n, %)	5 (71.4%)	2 (28.5%)	0	7	-

IQR: interquartile range

Table 3. Relationship between life expectancy and parameters of groups

	In-hospital (n=119)		Out-of-hospital (n=83)	
Parameters	r	p	r	p
Lactate	-0.252	0.006*	0.110	0.322
pH	0.119	0.199	0.046	0.680
BD, mmol/L	0.104	0.259	-0.134	0.226
K, mmol/L	0.084	0.364	0.008	0.941

Values less than p<0.05 were considered significant, r-values were calculated using the Spearman correlation test.

BD: base deficit, K: potassium

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arrest in men depends on the fact that ischemic heart disease is more common in this sex than in women (11).

In the study conducted by Petrie et al. (12), in which out-of-hospital arrest cases were examined, Ontario Prehospital Advanced Life Support, the average age of out-of-hospital cardiac arrest cases was 68, and in the National Registry of Cardiopulmonary Resuscitation study conducted by Peberdy et al. (13), the mean age of in-hospital arrest was 67.60.

In our study, 59.90% of the cases were male when demographic data was examined. The average age of those with in-hospital arrest was 77, and the average age of those with out-of-hospital arrest was 73. These findings were consistent with other studies.

Cardiac arrests are divided into in-hospital and out-of-hospital. Emergency departments are where both in-hospital arrests are common and out-of-hospital arrests are intervened as a result of transfer to the hospital (14). Mortality in cardiac arrests that develop outside the hospital is usually associated with prehospital factors (15). Studies have shown that they are more likely to live in witness arrests (14,16).

In our study, it was determined that non-hospital arrests were mostly brought by patient relatives (54.21%). This suggests to us that society is incapable of recognizing cardiac arrest and using the 112 emergency system for this purpose. We think that there is a need for more training in using 112 emergency health services for the right purpose and basic life support in the society.

In addition, it is important to have accessible automatic external defibrillators in crowded areas and to train people who can use these devices.

The main factor affecting mortality is having multiple comorbid diseases with increasing age (17). In most of these cases, the most common accompanying comorbid disease is structural heart disease, particularly coronary atherosclerosis and/or cardiomegaly (18). In accordance with the medical literature, ischemic heart disease (30%) was detected in the majority of patients in our study (18-20). Co-morbidities accompanying the cases taken in the study are given in detail in Table 2.

A long period of resuscitation in patients undergoing CPR shows an increased mortality rate (20). Mortality is higher if the resuscitation attempt lasts longer than 10 minutes. In our study, the average duration of resuscitation was 40 minutes (30-50).

Hypoxia, which develops in tissues with the development of cardiac arrest and prolonged resuscitation times, leads to the use of anaerobic metabolism and an increase in lactate levels in the blood. Acute myocardial ischemia results in an increase in intracellular potassium ions (21). Therefore, in order to evaluate whether CPR applied to the patient is effective or not, the arterial blood gas and the patient's blood pH, potassium and lactate level, base deficiency should be followed while resuscitation procedures continue. In this study, the relationship between CPR duration and blood gas results is given in detail in Figure 1.

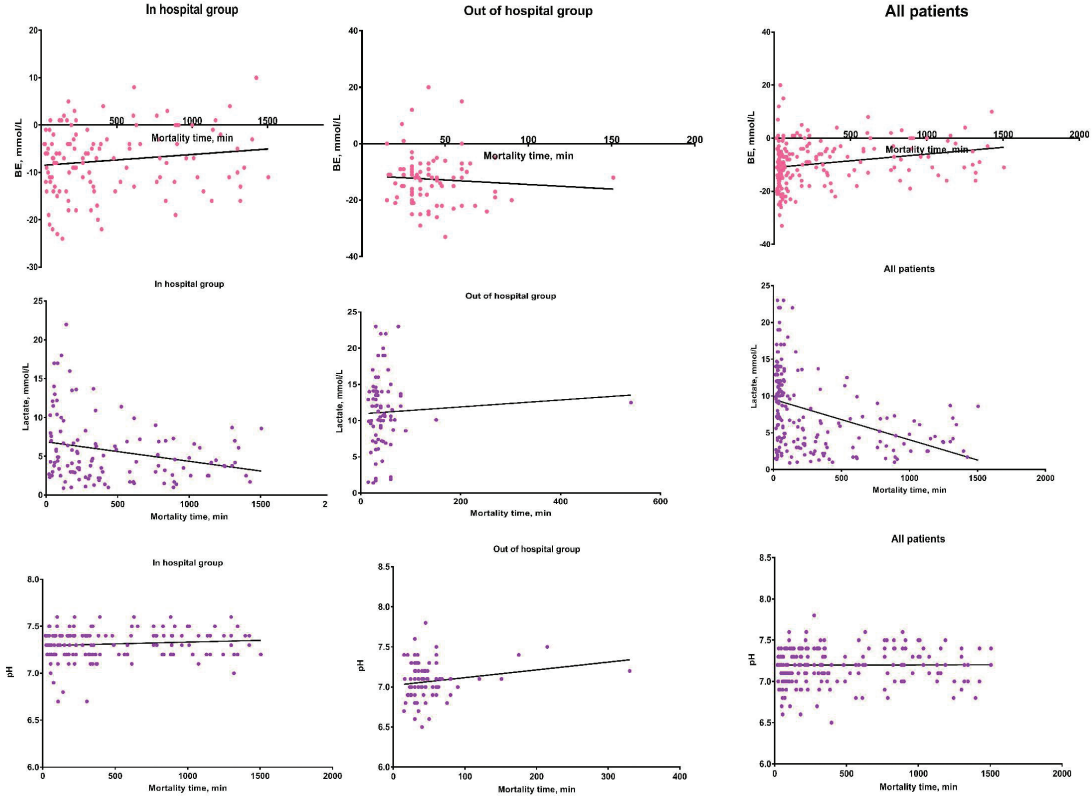

Figure 1. Relationship between CPR duration and blood gas results
CPR: cardiopulmonary resuscitation

Study Limitations

Because our study was retrospective and created study data for deceased patients, the control group could not be created. In addition, the fact that our sample numbers were small was also a factor that limited us.

CONCLUSION

Cardiopulmonary arrest is a very important health problem that is common in emergency departments and has a high rate of mortality. Community awareness should be raised about early recognition, timely and correct intervention, and rapid transfer to the hospital, especially cases that are arrested outside the hospital. Advanced age, concomitant co-morbid diseases, prolonged CPR durations are directly associated with mortality.

Ethics Committee Approval: For this retrospectively planned study, approval was obtained from the ethics board from a Şişli Hamidiye Etfal Training and Research Hospital (approval number: 2691, date: 25.02.2020).

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