Results of Out-of-Hospital Cardiopulmonary Arrest Cases with Intervention by Lay Rescuers and Emergency Health Workers

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Abstract

Aim: In this study, all interventions made by lay rescuers and health professionals and the shortcomings for cardiopulmonary arrest management outside the hospital were examined.

Materials and Methods: The study was conducted between December 2012 and May 2014 in the Emergency Department of Gaziantep University. To ensure orderly and standardized records, a study form was prepared that consisted of 31 questions. The time and location of the cardiac arrest, information regarding the lay rescuers and professional health workers, and the practices followed during transport and at the emergency service were examined. Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) for Windows software version 22.0, and $p<0.05$ was accepted as statistically significant.

Results: Of the 205 cardiac arrests, 69.8% were male and 30.2% were female. The mean age in all of the cases was 58.34±19.1 years. The cardiac arrests mostly occurred in the home environment (62.4%) and happened between 13.00 and 20.00 hours (43.4%). The most frequent conditions that caused a worsening of the cases were syncope (unresponsiveness) (35.6%). The people who identified the cardiac arrest case and called for help by informing emergency health personnel (EHP) were mostly family members (50.7%). The activation time was 14.27±20.30 min. The time to arrive at the scene was 8.4±6.4 (1–35) min. Lay rescuers performed resuscitation in 19.5% of cases. The most frequent rhythms on the arrival of the EHP were asystole (74.1%). EHP evaluated the glaskow coma scale (GCS) of 88.3% of the cases as ≤7 at the scene. EHP performed basic life support (BLS) on all cases (100%) and endo-tracheal intubation (ETI) on 29.3% of the cases at the scene. The on-scene time and transport time to ED were 8.09±8.82 and 9.02±7.92 (1-50) min, respectively. The average duration of CPR at ED was 35.15±16.9 min. Of all the cases, 7.8% were discharged from intensive care unit (ICU) to homes. Of all the cases, 77.6% died at the ED, and 14.6% died in ICU.

Conclusion: The intervention rate by lay rescuers was far less than the international rates. The survival rates were generally below the internationally reported rates. There is no adequate public awareness in our area for identifying cardiac arrest in patients and for initiating early chest compressions. *(Eurasian J Emerg Med 2016; 15: 7-14)*

Keywords: Out-of-hospital cardiopulmonary arrest, lay rescuer, emergency health staff, emergency department, survive, mortality

Introduction

The prompt identification of cardiac arrest cases, activation of emergency health personnel (EHP), early initiation of chest compressions, early defibrillation, competency in basic life support (BLS) practices, and the correct application of BLS are keys to obtaining significantly positive results in out-of-hospital cardiac arrest (OHCA) (1-4). Chest compressions performed alone by the lay rescuer are an essential basic step for successful resuscitation during cardiac arrest and can increase the rate of survival by two-fold (2-4). However, despite technological improvements and advances in telecommunication tools, the discharge rates of OHCA cases from the hospital are quite low (2.5%–25%) (5).

Even in developed countries, such as the USA and Canada, the estimated intervention incidence in OHCA cases is approximately 50–55/100.00 per year (6). Additionally, the rate of CPR application by lay rescuers in OHCA ranges from 20% to 30% (4). In Turkey, no studies have been conducted to provide exact data regarding intervention in OHCA cases. In general, a very important fraction of OHCA cases cannot receive proper and sufficient CPR intervention from lay rescuers and health workers in the world. This is the reason for the high mortality rates observed in OHCA patients.

The most important step toward solving this problem is to raise awareness in the population with ongoing education for the prompt identification of cardiac arrest, early chest compressions, and the use of an AED to increase the chance of survival without any sequela from increasing perfusion to vital organs in OHCA cases (7).

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Although there are some studies on the outcomes of cardiopulmonary resuscitation (CPR) in hospitals, no prospective study has been conducted regarding the outcomes of CPR in OHCA cases. We aimed to obtain the required data (such as morbidity, mortality) related to OHCA cases in our region. Therefore, we prospectively investigated how lay rescuers identified arrest cases; how they called EMS; the BLS applications with chest compressions performed first; the life-saving interventions performed by emergency medical system (EMS) personnel at the scene, during transportation, and at the emergency service; previous CPR training of the EMS personnel and lay rescuers; and the effects of all of these on mortality and morbidity in OHCA cases in the city of Gaziantep.

Materials and Methods

Before the study

We obtained approval from the Gaziantep University, School of Medicine, Medical Ethics Committee (Ethics Committee decision nr: 19.06.2012/277 Date: 19.06.2012) and complied with the Helsinki Declaration in this study. The study was conducted prospectively from December 1, 2012 to May 31, 2014, in collaboration with the Gaziantep University, School of Medicine, Department of Emergency Medicine, and the Gaziantep Health Board EMS Branch Directorship.

Study area

Gaziantep province covers an area of 6,222 km^2, and it is the sixth most populated city (population of the city center is 1,800,000) in Turkey. Within the body of the City Health Board, there are 33 of 112 Emergency Medicine Service (EMS) stations, with 536 personnel. Of these personnel, 320 are emergency medicine technicians (EMT), 80 are paramedics, 21 are health officers, and 35 are general practitioners. Five of the EMS stations in the city center have a doctor working on the team. There is a 24/7 attending doctor at the head of the 112 Command Control Center (112 CCC). The average daily number of telephone calls to EMS is 15,000. Of these calls, only approximately 300 (2%) are considered emergency cases that require an ambulance team to be sent, whereas the other calls (98%) are recorded as ungrounded cases. There are in total 97 ambulances in service in the EMS Branch: 34 of the ambulances are for emergency aid, 58 are for transportation, two are for transportation with four stretchers, and one is for transporting obese patients. Additionally, there are two motorcycle teams. According to the data provided by the City Health Board, the average time required for an ambulance to reach a patient is 9 min.

Preparation and recording of study forms

To ensure orderly and standardized records, a study form was prepared that consisted of 31 questions. Before the study, all of the 112 emergency health professional (EHP) were informed about the purpose of the study and how to complete the forms. No education was given regarding emergency interventions during cardiac arrest to any of the EHP. We expected that they would practice using their own training. To detect possible faults for completing the forms, a preliminary study was conducted where the forms were filled in for 10 cases of cardiac arrest. All of the EHP were warned about the faults detected in this preliminary study. The cases in the preliminary study were excluded from the actual study. Teams dealing with cardiac arrest cases handed the forms that they had completed to the command and control center (CCC) daily at the end of their shifts. These forms were collected weekly from the CCC by the study conductor, and the data were recorded using a computer.

Information obtained from the form

Time and location of cardiac arrest

- Time of the day and where the cardiac arrest happened.

With regard to lay rescuers:

- Did they quickly identify cardiac arrest?
- Did they activate the EMS system (activation time)?
- Delay before activation of the EMS system
- Did they engage in any life-saving interventions until the arrival of EHP?
- Did they initiate early chest compressions?
- Have they ever been trained for BLS practices (and if so, where)?

With regard to professional health workers

- Did they guide lay rescuers in simple interventions beginning from the moment of the emergency call?
- What was the time for the ambulance to arrive at the scene (response time)?
- What was the condition of the case at the time of arrival of the emergency team, and what was the first detected cardiac rhythm?
- What were the BLS and ACLS interventions that were performed at the scene?
- Did they defibrillate the case at the scene?
- What was the duration of interventions that they performed at the scene (on-scene time)?
- How long have they been practicing in their profession?
- What are their training levels regarding BLS and ACLS, and what courses have they attended?

Practices during transport and in the emergency service

- Interventions performed in the ambulance
- Time to arrive at the emergency service (transport time)
- Interventions performed at the emergency department (ED)
- Duration of CPR performed on the patient at the ED
- Mortality and morbidity of the case at the ED
- Mortality and morbidity of the case in wards and intensive care units (ICU)

Inclusion criteria

- Cardiac arrest taking place outside the hospital
- Adult cases over 16 years old (patients less than 16 years old who received intervention at the scene are not followed up by adult emergency service doctors)
- Patients who had cardiac arrest within 30 min before the arrival of the EHP

Exclusion criteria

- Patients under 16 years old
- Patients who were determined to have had a cardiac arrest more than 30 min before the arrival of EHP
- Patients who had a cardiac arrest at the hospital
- Incomplete completion of the study forms

Table 1. Demographic data of the study

Table 1. Demographic data of the study

	n	%
Gender		
Male	143	69.8
Female	62	30.2
Witnessed arrest	164	80
Scene of event		
At home	128	62.4
Rural areas (e.g., picnic areas, agricultural fields)	29	14.1
Downtown	26	12.7
Public places (e.g., shopping centers, stadiums)	15	7.3
Miscellaneous*	7	3.4
Timeframe when health condition deteriorated		
08^{00}–12^{00} Hours	44	21.5
13^{00}–20^{00} Hours	89	43.4
21^{00}–07^{00} Hours	72	35.1
Complaint of the case that caused deterioration		
Chest pain	33	16.1
Difficulty in breathing	51	24.9
Syncope (unresponsiveness)	73	35.6
Trauma	27	13.2
Gunshot wound	5	2.4
Miscellaneous	16	7.8
The person who activated EMS		
Family member	104	50.7
A person recognized by the patient	58	28.3
A person unrecognized by the patient	23	11.2
Patient themselves	20	9.8
Intervention by lay rescuer		
Yes	40	19.5
No	165	80.5
First rhythm at scene detected by EHP		
Asystole	152	74.1
VF	15	7.3
PVT	12	5.9
PEA	7	3.4
Sinus bradycardia	10	4.9
Sinus tachycardia	6	2.9
Normal sinus rhythm	3	1.5
Training of lay rescuer		
Yes	20	50
No	20	50
Where did the lay rescuer have his/her training		
Courses in schools and workplaces	4	10
In-service training (health worker)	16	40
No formal training, visual/auditory information (Untrained rescuer)	20	50
EHP performing the intervention		
Doctor	32	15.6
Paramedic	75	36.6
EMT	97	47.3
Health officer	1	0.5
In-service training of EHP who performed interventions		
No training	3	1.5
TRC*	54	26.3
Basic module	58	28.3
ALS**	62	30.2
PALS***	28	13.7

*Miscellaneous: outpatient centers (e.g., health centers medical centers, dialysis units), **ALS: advanced life support, ***PALS: pediatric advanced life support; TRC: trauma resuscitation course; EMT: emergency medical technician; EMS: emergency medicine staff; EHP: emergency health professional; VF: ventricular fibrillation; PVT: pulseless ventricular tachycardia; PEA: pulseless electrical activity

Evaluation of the results

During the 18-month study period, 688 cardiac arrest cases were reported in the records of CCC in the city center of Gaziantep. In total, 483 of the cases were excluded from the study: 4 cases were under 16 years old, 24 cases were determined to have had a cardiac arrest more than 30 min before the initiation of intervention, 51 cases did not need CPR at the scene, 10 cases were included in the preliminary study, and 394 cases had missing information on the forms. The remaining 205 cases (30%) were included in the study.

Statistical analysis

A Kolmogorov–Smirnov test was used to assess the normality of the continuous variables. Student's t test was used to compare the normally distributed variables in two independent groups, and the Mann–Whitney U test was used to compare non-normally distributed variables between two independent groups. A Kruskal–Wallis test and Dunn multiple comparison tests were used to compare more than two independent groups. The correlation between categorical variables was tested using Chi-square analysis. The correlation between numerical variables was tested using a Spearman rank correlation coefficient. Descriptive statistics were given as the frequency, percentage, and mean±std. deviation. Statistical analyses were performed using the Statistical Package for the Social Sciences (IBM SPSS Statistics; New York, USA) for Windows software version 22.0. $p<0.05$ was accepted as statistically significant.

Table 2. Findings at the scene, interventions in the case, and outcomes

	Result				
	Discharged from ward n (%)	**Discharged from ICU n (%)**	**Death at ICU n (%)**	**Death at emergency service n (%)**	**p**
Gender					
Male	5 (3.5)	7 (4.9)	20 (14)	111 (77.6)	
Female	1 (1.6)	3 (4.8)	10 (16.1)	48 (77.4)	0.868
Scene					
At home	4 (3.1)	4 (3.1)	21 (16.4)	99 (77.3)	
Public places (e.g., mall, stadium)	0	2 (13.3)	2 (13.3)	11 (77.3)	
Downtown	2 (7.7)	2 (7.7)	2 (7.7)	20 (77.9)	0.648
Rural areas (e.g., picnic field, agricultural field)	0	1 (3.4)	4 (13.8)	24 (82.8)	
*Miscellaneous	0	1 (14.3)	1 (14.3)	5 (71.4)	
Timeframe of deterioration					
08^{00}–12^{00} Hours	1 (16.7)	2 (20)	3 (10)	38 (23)	
13^{00}–20^{00} Hours	3 (50)	5 (50)	14 (46.7)	67 (42.2)	0.948
21^{00}–07^{00} Hours	2 (33.4)	3 (30)	13 (43.3)	54 (35.9)	
Lay rescuer					
Yes	1 (16.7)	3 (30)	9 (30)	27 (17)	0.360
No	5 (83.3)	7 (70)	21 (70)	132 (83)	
Initial condition of case					
GCS 3–7	4 (2.2)	6 (3.3)	23 (12.7)	148 (81.8)	0.003
GCS 8–11	2 (8.3)	4 (16.7)	7 (29.2)	11 (45.8)	
ACLS					
Yes	2 (33.3)	8 (80)	18 (60)	97 (61)	0.314
No	4 (66.7)	2 (20)	12 (40)	62 (39)	
Defibrillation					
Yes	0	1 (4.8)	1 (4.8)	19 (90.5)	0.280
No	6 (3.3)	9 (4.9)	29 (15.8)	140 (76.1)	
Intervention by lay rescuer trained for BLS					
Yes	0	2 (66.7)	5 (55.6)	13 (48.1)	0.599
No	1 (100)	1 (33.3)	4 (44.4)	14 (51.9)	
Complaint preceding cardiac arrest					
Chest pain	1 (3)	2 (6.1)	5 (15.2)	25 (75.8)	
Difficulty in breathing	4 (7.8)	2 (3.9)	9 (17.6)	36 (70.6)	
Syncope	0	1 (1.4)	7 (9.9)	63 (88.7)	0.277
Trauma	1 (3.7)	2 (7.4)	4 (14.8)	20 (74.1)	
Gunshot wound	0	1 (20)	1 (20)	3 (60)	
*Miscellaneous	0	2 (11.8)	4 (23.5)	11 (64.7)	
Initial rhythm detected by EHP					
Asystole	2 (1.3)	5 (3.3)	20 (13.2)	125 (82.2)	
VF	0	3 (20)	3 (20)	9 (60)	
PVT	0	0	1 (8.3)	11 (91.7)	
PEA	1 (14.3)	0	0	6 (85.7)	0.030
Sinus bradycardia	1 (10)	1 (10)	4 (40)	4 (40)	
Sinus tachycardia	1 (16.7)	1 (16.7)	1 (16.7)	3 (50)	
Normal sinus rhythm	1 (33.3)	0	1 (33.3)	1 (33.3)	

*Miscellaneous: outpatient centers (e.g., health centers medical centers, dialysis units). BLS: basic life support; ACLS: advanced cardiac life support; EHP: emergency health professional; ICU: intensive care unit; PEA: pulseless electrical activity; PVT: pulseless ventricular tachycardia; VF: ventricular fibrillation; GCS: Glasgow coma scale

Results

Of the 205 cardiac arrest cases that were included in the study during the 18-month study period, 143 (69.8%) were male and 62 (30.2%) were female (Table 1). The mean age in all of the cases was 58.34±19.1 (16–95) years. The cardiac arrests mostly occurred in the home environment (n=128, 62.4%) or in suburban streets (n=29, 14.1%) between 13.00 and 20.00 hours (n=89, 43.4%). The exact numbers of witnessed arrests were 164 (80%). The most frequent conditions that caused worsening of the cases were syncope (unresponsiveness) (n=73, 35.6%) and breathing difficulty (n=51, 24.9%). The conditions in 16 (7.8%) cases were grouped as "miscellaneous" and included epileptic seizures, cerebrovascular accidents, anaphylaxis, hanging, foreign object aspiration, massive hemoptysis, epistaxis, substance abuse, smoke inhalation, electric shock, detonation, and stab wound. The people who identified the cardiac arrest case and activated EMS were mostly family members (n=104, 50.7%) and friends (n=58, 28.3%). The activation time of EMS was 14.27±20.30 (1–180) min. (Table 1). EHP arrived at the scene after 8.4±6.4 (1-35) min from the emergency call. In six cases (3%), 112 CCC personnel guided the calling person for emergency intervention over the phone (chest compression in three cases, maintaining the airway in two cases, and emergency bleeding control in one case).

The lay rescuers performed resuscitation in 40 (19.5%) cases. People who had previously received first-aid training made half of these interventions. Sixteen (16%) of them were health workers who were at the scene by chance at that time. Four of the untrained people stated that they had witnessed CPR before, and two of them stated that they had seen a CPR application on TV. The remaining 14 untrained people stated that they performed CPR according to what they had heard before. The most frequent rhythms on the arrival of the EHP were asystole (n=152, 74.1%), VF (n=15, 7.3%), and pulseless VT (n=12, 5.9%) (Table 1). EHP performed BLS on 205 (100%) cases, ACLS on 126 (61%) cases, defibrillation on 21 (10.2%) cases (15 asystole, 5 VF, 1 PEA), and endotracheal intubation (ETI) on 60 (29.3%) cases at the scene. A significant part of these interventions were performed by EMT (n=97, 47.3%) and by paramedics (n=75, 36.6%) (Table 1). The mean experience of the EHP who performed the interventions was 5.72±3.81 (1–20) years. The ratios of the last in-service training of the EMS personnel are given in Table 1. Only three (1.5%) personnel had not completed any training before because they were new hires. The mean duration after the completion of the courses was 1.50±1.50 (0–6) years.

The mean on-scene time (duration between the arrival of the ambulance at the scene and its departure) was 8.09±8.82 (1–77) min. During transport, 180 (87.8%) cases received CPR in the ambulance. The transport time (mean duration to arrive at the hospital starting at departure from the scene) was 9.02±7.92 (1–50) min. According to the evaluation of the GCS of the cases by EHP at the moment of arrival at the scene, 181 (88.3%) cases had GCS ≤7, and the remaining 24 (11.7%) cases had GCS between 8 and 11. At the time of arrival at the hospital, 159 cases (78.7%) had GCS ≤7, 30 cases (14.6%) had GCS between 8 and 10, and six cases (2.9%) had GCS ≥11. In the emergency service, ETI was performed on 93 patients and CPR was performed on 174 patients, with an average duration of 35.15±16.9 (2–113) min. As a result, 10 of the cases who were determined to have GCS ≤7 at the scene (10/181, 5.5%) and six of the cases who were determined to have GCS between 8 and 11 at the scene (6/24, 25%) were discharged after admission to ICU.

Table 3. Performance measures of emergency health professionals

	Application		
	Yes n (%)	**No n (%)**	**p**
Training of the EHP BLS application			
No training	2 (1)	0	
TRC	54 (26.7)	0	
Basic module	56 (27.7)	2 (100)	0.279
ALS	62 (30.7)	0	
PALS	28 (13.9)	0	
Professional distribution BLS application			
Doctor	32 (15.8)	0	
Paramedic	74 (36.6)	1 (50)	0.812
EMT	96 (47.5)	1 (50)	
Training of the EHP ACLS application			
No training	1 (0.8)	1 (1.3)	
TRC	31 (24.8)	23 (29.1)	
Basic module	37 (29.6)	21 (26.6)	0.898
ACLS	40 (32)	22 (27.8)	
PALS	16 (12.8)	12 (15.2)	
Professional distribution ACLS application			
Doctor	16 (50)	16 (50)	
Paramedic	54 (72)	21 (28)	0.035
EMT	54 (55.7)	43 (44.3)	

BLS: basic life support; ALS: advanced life support; PALS: pediatric advanced life support; EMT: emergency medicine technician; TRC: trauma resuscitation course; EHP: emergency health personnel; ACLS: advanced cardiac life support

Table 4. Outcomes depending on durations

	n	**Mean**	**p**
Duration of CPR and outcome			
Discharged after admission to ward	6	16.16±8.25	
Discharged after admission to ICU	10	29.6±16.92	0.006
Death in ICU	30	35.83±23.3	
Death in emergency service	159	36.08±15.41	
Duration before activation of EMS and outcome			
Discharged after admission to ward	6	26±24.7	
Discharged after admission to ICU	10	8.9±9.9	0.342
Death in ICU	30	14.1±15.1	
Death in emergency	159	14.1±21.4	

EMS: emergency medicine services; ICU: intensive care unit; CPR: cardiopulmonary resuscitation

Following intervention at the scene, in the ambulance, and at the ED, 159 of the cases (77.6%) died in the emergency service, and 30 of the cases (14.6%) died in the ICU. Sixteen (7.8%) were discharged from the ICU. The general mortality was calculated as 92.2%. The mean duration of CPR for the patients who were resuscitated at the ED and admitted to the ICU was 16.16±8.2 min.

There was no statistically significant association between survival and the location of the cardiac arrest *(*p=0.648), the timeframe of the event (p=0.948), the condition that caused worsening of the case (p=0.277), whether a lay rescuer intervened (p=0.360), whether the lay rescuer had BLS training or not (p=0.599), the average time for EHP teams to arrive at the scene (p=0.342), and whether BLS (p=0.796) and ACLS (p=0.314) practices were performed at the scene (Table 2). The relationship between the initial conditions of the cases and the airway maintenance type was not statistically significant (p=0.132). The survival and discharge rates of the patients who were determined to have sinus tachycardia and bradycardia at the scene were statistically higher than those who were determined to have fatal rhythms (VF, PVT, asystole, and PEA) (p=0.030) (Table 2). There were no statistically significant correlations between the experience of EMS personnel, their in-service training, and whether they performed BLS (p=0.279) and ACLS (p=0.898). In contrast, paramedics were more active in ACLS practices than were EMTs and doctors (p=0.035) (Table 3). The EMS personnel performed defibrillation for the first 15-asystole rhythms that they identified. However, whether defibrillations were performed correctly or incorrectly did not affect the patient's outcome (p=0.280). Whether lay rescuers called for EMS early or late did not affect survival (p=0.342), whereas the survival rates were higher in patients who received a shorter duration of CPR (p=0.006) (Table 4). Whether cardiac arrests took place near or far from the health centers did not have a statistically significant effect on the outcomes (p=0.648). The mortality among patients with a GCS <7 at scene was statistically significant high (p=0.003) (Table 2).

Discussion

The reason why most of the OHCA events occur at home is because elderly patients who have co-morbidities and are thus at a high risk of mortality spend most of their time at home. The second most likely location was found to be suburban streets. We believe that this is because the population of elderly people is dense and that they do not receive adequate health care in these areas. The most frequently detected conditions preceding cardiac arrest, such as cerebrovascular events chest pain and breathing difficulty, were the same as those found in other studies (8-10). These results support the theory that cardiopulmonary and cerebrovascular events are one of the leading causes of sudden death in elderly patients. The explanation for why 4/5 of our cases were witnessed by someone is that most of the OHCA cases occurred in the family environment. In related studies (8-13), the ratio of witnessed OHCA cases varies from 33%–65%. Those studies have reported that people tend to live alone as the socio-cultural and economical levels rise; one indication of this is the decreasing rate of witnessed cardiac arrest cases at homes. As for our region, older family members of people who have low and moderate incomes live with their children until their death. The finding that most of the witnesses were family members supports this idea. However, the high rates of witnessed cardiac arrests in our study did not result in emergency calls being made quickly. We think that the reason for the late activation time long duration was because witnesses could not comprehend the critical condition of the patient or thought that "they would take the patient to the hospital later." Considering this finding, the family members of patients with a high risk of sudden death might be educated on BLS to increase the awareness of the importance of early interventions in OHCA cases. This education would be valuable because most of the OHCA cases occur at home (8, 14).

Our study showed that 112 CCC personnel could not adequately direct the callers on the phone in the emergent interventions that they had to perform. Their guidance is important to increase the chance of survival of the patient; thus, the failure of this guidance needs to be addressed. In our study, half of the lay rescuers who performed chest compressions on the arrested case did not have any previous training, which may indicate that they were willing to undertake BLS; they should thus be formally trained for correct emergency intervention. Even though their intervention did not have a statistically significant effect on patient outcome, it does not mean that they could not cause harm to the patient.

The results of the studies conducted in Qatar (9), Finland (9), and the U.S. (11) indicate that the mean age of OHCA cases tends to increase going west from the Middle East (57–68 years). The mean age of cases in our study is higher than those found in countries located east of Turkey and lower than those located west of Turkey. Quick arrival at the scene is the most important controllable factor that has an influence on the discharge rates of OHCA. Petrie et al. (12) proposed that CPR and transport to an emergency service is unnecessary when the case is determined to have asystole and when the time required to arrive at the scene is longer than 8 min; they reported 100% mortality rates in these cases. Takei et al. (15) reported that activating EHP within ≤6 min significantly increased the survival rates in all OHCA cases. Moon (11) supported the idea that the prompt calling of emergency teams increases the chance of survival. In contrast, other studies have reported that arriving at the scene sooner does not statistically affect the survival rates (10, 16). Although our results also support this idea, EHP encountered a large number of cases with asystole due to both late calls from the witnesses and late arrival of the EHP team at the scene. We think that these delays play an important role in mortality.

According to studies in Europe and America, such as those conducted by Moon (11), Hiltunen et al. (8), Petrie et al. (12), Van der Hoeven et al. (13), and a meta-analysis by Sasson (14), the rate of BLS interventions performed by lay rescuers varies 35.15±16.9 (2–113) min from 14%–47%. Those studies state that the main reason for the increasing rates is the education of lay rescuers. The results of a study conducted in Sweden (17) prove this statement to be true. In that study, public education regarding BLS practices has been performed for 25 years; as a result, the intervention rates by lay rescuers have risen from 31% to 55%. Another study emphasized that this rate can drop to 6.2% if no education occurs (16). Although the intervention rates by lay rescuers in our study seem to be similar to reports in previous studies, this rate can fall below the reported rates (<%10) when we subtract the interventions performed by health workers who were at the scene at that time by chance. Very few lay rescuers had training for BLS, which indicated that public education is not adequate in our city. There were rescuers who had no training but intervened according to what they had seen in visual media; this finding suggests that media can be used to increase public awareness of OHCA. We think that the reason why the interventions performed by lay rescuers did not have a statistically significant effect on survival is that those interventions were late and ineffective.

A GCS ≤7 at the initial evaluation of the scene was correlated with a higher mortality rate (p=0.003). In addition, airway control with ETI could be performed only in one-third of the patients with a GCS ≤7. This low rate of ETI intervention could be due to not wanting to lose time at the scene and due to pressures from the patient's relatives to transport the patient as soon as possible. Henlin et al. (18) emphasized that the time spent on performing ETI at the scene causes a delay in chest compressions and decreases the survival rate. In one study by McMullan et al. (19), which included 10,691 cases, although the rate of ETI application at the scene was 52%, the ratio of those who survived was 5.4%.

In our study, the rate of shockable rhythms detected by EHP at the scene was similar to other reports in the literature, but the asystole rate was higher. In various studies and meta-analyses (8, 9, 11, 12, 14), the rates of shockable (VF/PVT) and non-shockable (asystole and PEA) rhythms detected at the scene varied between 13%–38% and 25%–45%, respectively. In one meta-analysis that included seven studies conducted in Europe, North America, Asia, and Australia, the VF rates varied from 11%–40% (20). Although EHP had basic training, such as BLS and ACLS, and had been practicing their profession for an adequate amount of time to gain competency, they performed defibrillation mostly in asystole cases rather than in shockable rhythms. This finding can be explained by their inadequate training. Hiltunen et al. (8) reported that despite a long delay between the detection of a shockable rhythm and defibrillation (9.5–12 min), defibrillation significantly increased patient survival. Fredriksson et al. (21) determined survival rates of 61% and 21% in shockable and non-shockable OHCA cases, respectively.

In studies by Sasson et al. (14) and Hiltunen et al. (8), the rates of BLS practices used for patients were 66.7% and 64%, respectively. Our higher rate is due to the differences in the exclusion criteria applied. However, performing CPR in a greater number of patients did not result in a lower mortality rate. Late activation of the EMS, late arrival at the scene, and fewer interventions performed by lay rescuers could explain this result. In our study, the duration of CPR at the scene was much shorter than the reported durations in the literature (10). However, it did not decrease the need for CPR or shorten the duration of CPR for the same patient at the emergency service. This finding could support the idea that performing CPR at the scene may not be effective. In our study, the duration of CPR performed at the emergency service was longer than the other reported times (16). However, the survival rates were higher in the patients in whom the average CPR durations were shorter (p=0.006). From the reverse perspective, this result indicates that a longer duration of CPR does not increase the chance of resuscitation.

One of the most comprehensive studies related to discharge rates of OHCA cases is a meta-analysis by Sasson et al. (14) that included 143,000 cases. Following CPR, the survival rates (24%) and discharge rates (7.1%) found in that study were similar to our results. In another meta-analysis conducted in Europe (22), the discharge rate was determined to be 10.7%. Aside from these studies, there are also reports of lower (0.3%–1.4%) (23, 24) and higher (28%–33%) (8, 25) discharge rates. In the studies with a higher discharge rate, the most effective factors were determined to be prompt identification of the cardiac arrest case, early chest compression, and early arrival of EHP at the scene.

Study limitations

Inattentive filling of the case forms decreased the number of our study population. Due to the limited time period in our study (18 months), the 6-month and 1-year survival rates of OHCA cases could not be assessed. Because CPR was not performed by the same personnel at the scene and at the emergency service, a standard could not be achieved. Because we could not detect whether the reason for death was late CPR or an important primary cause with a high mortality risk, such as multiple traumas or serious intracranial hemorrhage in the mortal cases, the evaluation of the effectiveness of the CPR interventions was restricted. Different types of arrest patients were also an important limitation in the current study.

Conclusion

Although the number of witnessed cardiac arrests was high, emergency calls were mostly delayed. Also, those who called EMS were not adequately guided by 112 CCC for emergency intervention. The intervention rate by lay rescuers was far lower than the international rates. There is not adequate public awareness in our area for identifying cardiac arrest patients and for initiating early chest compressions. The survival rates in the area are generally below the internationally reported rates.

The in-service training of EHP should be reviewed and inspected. Training programs should be based on modern simulation practices and should include actual scenarios. The relatives of patients who have an especially high mortality risk should be educated on BLS. Public awareness about cardiac arrest cases should be increased via visual and social media tools, and interested parties should be trained.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Gaziantep University School of Medicine.

Informed Consent: It was not able to receive the informed consent because of their arrest.

Peer-review: Externally peer-reviewed.

Conflict of Interest: The authors declare that they did not have conflict of interest in current study.

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References

1. Cave DM, Gazmuri RJ, Otto CW, Nadkarni VM, Cheng A, Brooks SC, et al. Cardiopulmonary resuscitation and emergency cardiovascular care. Circulation 2010; 122: 720-8. [CrossRef]
2. Kajino K, Yonemoto N, Yukioka H, Sugimoto H, Kakuchi H, Sase K, et al. Effectiveness of bystander-initiated cardiac-only resuscitation for patients with out-of-hospital cardiac arrest. Circulation 2007; 116: 2900-7. [CrossRef]
3. SOS-KANTO Study Group. Cardiopulmonary resuscitation by bystanders with chest compression only (SOS-KANTO): an observational study. Lancet 2007; 369: 920-6. [CrossRef]
4. Ong ME, Ng FS, Anushia P, Tham LP, Leong BS, Ong VY, et al. Comparison of chest compression only and standard cardiopulmonary resuscitation for out-of-hospital cardiac arrest in Singapore. Resuscitation 2008; 78: 119-26. [CrossRef]

5. Ornato JP. Sudden cardiac death in Tintinalli's Emergency Medicine by Tintinalli JE, Stapczynski J, Cline MD, Ma J, Cydulka RK, Meckler GD. 7th ed. The McGraw-Hill Companies 2011 China pp. 63-7.
6. Nichol G, Thomas E, Callaway CW, Hedges J. Regional variation in out-of-hospital cardiac arrest incidence and outcome. JAMA 2008; 300: 1423-31. [CrossRef]
7. Bobrow BJ, Clark LL, Ewy GA, Chikani V. Minimally interrupted cardiac resuscitation by emergency medical services for out-of-hospital cardiac arrest. JAMA 2008; 299: 1158-65. [CrossRef]
8. Hiltunen P, Kuisma M, Silfvast T, Rutanen J, Vaahersalo J, Kurola J, et al. Regional variation and outcome of out-of-hospital cardiac arrest (ohca) in Finland - the Finnresusci study. Scand J Trauma Resusc Emerg Med 2012; 20: 80. [CrossRef]
9. Patel AA, Arabi AR, Alzaeem H, Al Suwaidi J. Clinical profile, management, and outcome in patients with out of hospital cardiac arrest: insights from a 20-year registry. Int J Gen Med 2014; 7: 373-81. [CrossRef]
10. Peyravi M, Ortenwal P, Djalali A. An Overview of shiraz emergency medical services dispatch to treatment. Iran Red Crescent Med J 2013; 15: 823-8. [CrossRef]
11. Moon S. Disparities in bystander CPR provision and survival from out-of-hospital cardiac arrest according to neighborhood ethnicity. AJEM 2014; 32: 1041-5. [CrossRef]
12. Petrie DA, De Maio V, Stiell IG. Factors affecting survival after prehospital asystolic cardiac arrest in a Basic Life Support - defibrillation system. CJEM 2001; 3: 186-92.
13. Van der Hoeven JG, Waanders H, Compier EA, Weyden PK. Evaluation of an emergency medical system, the prognosis in patients with an out of hospital cardiac arrest. Netherlands J Med 1994; 44: 5-11.
14. Sasson C, Hegg AJ, Macy M, Park A, Kellermann A. Pre-hospital termination of resuscitation in cases of refractory out-of-hospital cardiac arrest. JAMA 2008; 300: 1432-8. [CrossRef]
15. Takei Y, Inaba H, Yachida T, Enami M, Goto Y, Ohta K. Analysis of reasons for emergency calldelays in Japan in relation to location: High incidence of correctable causesand the impact of delays on patient outcomes. Resuscitation 2010; 81: 1492. [CrossRef]
16. Akbulut F. Analysis of Cardiac Arrest Cases in the emergency service of Dokuz Eylul University Hospital Between January 2007 and June 2010. Doctorate thesis. Puplishing of Dokuz Eylul University, Izmir, 2010. p. 16-25.
17. Stromsoe A, Andersson B, Ekstrom L. Education in cardiopulmonary resuscitation in Sweden and its clinical consequences. Resuscitation 2010; 81: 211-6. [CrossRef]
18. Henlin T, Michalek P, Tyll T. Oxygenation, ventilation, and airway management in out-of-hospital cardiac arrest: a review. Biomed Res Int 2014; 37: 68-71. [CrossRef]
19. McMullan J, Gerecht R, Bonomo J, Robb R, McNally B, Donnelly J, et al. Airway management and out-of-hospital cardiac arrest outcome in the CARES registry. Resuscitation 2014; 85: 617-22. [CrossRef]
20. Berdowski J, Berg R. Global incidences of out-of-hospital cardiac arrest and survival rates: Systematic review of 67 prospective studies. Resuscitation 2010; 81: 1479-87. [CrossRef]
21. Fredriksson M, Aune S, Bang A, Thoren AB, Lindqvist J, Karlsson T, et al. Cardiac arrest outside and inside hospital in a community: Mechanisms behind the differences in outcome and outcome in relation to time of arrest. Am Heart J 2010; 159: 749-56. [CrossRef]
22. Atwood C, Eisenberg MS, Herlitz J, Rea TD. Incidence of EMS-treated out-of- hospital cardiac arrest in Europe. Resuscitation 2005; 67: 75-80. [CrossRef]
23. Dunnea RB, Comptona S, Zalenskib RJ, Sworc R. Outcomes from out-of-hospital cardiac arrest in Detroit. Resuscitation 2007; 72: 59-65. [CrossRef]
24. Eckstein M, Stratton SJ, Chan LS. Cardiac arrest resuscitation evaluation in Los Angeles: CARE-LA. Ann Emerg Med 2005; 45: 504-9. [CrossRef]
25. Kamarainen A, Virkkunen I, Yli-Hankala A, Silfvast T. Presumed futility in paramedic-treated out-of-hospital cardiac arrest: an Utstein style analysis in Tampere, Finland. Resuscitation 2007; 75: 235-43. [CrossRef]