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Orgınal Article

Effect of Intermittent Online Training on Adult Cardiopulmonary Resuscitation Management in A Tertiary Care Setting

Üçüncü Basamak Bir Acil Serviste Çevrim İçi Ve Tekrarli Eğitimlerin Erişkin Kardiyopulmoner Resüsitasyon Yönetimine Etkisinin Araştirilmasi

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Highlights

- Correct drug administration rates increased after training.
- There was a significant increase in the use of capnography after training.

Abstract

Background: Cardiac arrest is one of the clinical conditions with the highest mortality rate in the emergency department. The purpose of this study was to assess the impact of education on the quality of cardiopulmonary resuscitation(CPR) performed on patients with out-of-hospital and in-hospital cardiac arrest, as well as to analyze other factors influencing Return of Spontaneous Circulation(ROSC).

Materials and Methods: This study was conducted in the Gulhane Training and Research Hospital's Emergency Department. Cardiopulmonary arrest patients' data were collected using the "Resuscitation Follow-up Form". Descriptive data, including adult arrest case characteristics and CPR protocols, were acquired. ROSC and CPR management parameters were compared in cases that received CPR before and after training.

Results: A total of 95 patients were included in the study. The mean age of the patients was 69,16±14,606. The 64,2%(n=61) of patients were cardiac arrest patients who were intervened before education and 35,7%(n=34) were after education. The ROSC rate in arrest patients before training was 36,1%, and 38,2% after training. When comparing the pre-training and post-training groups in terms of ROSC, it was seen that the ROSC rates increased after the training. While the rate of EtCO2 use was 3,3%(n=2) in pre-training cases, this rate was 97,1%(n=33) in post-training cases. EtCO2 usage rate increased significantly with education(p=0.001). **Conclusions:** It was observed that EtCO2 usage and correct drug administration increased after the training. It was determined that repetitive trainings improved CPR management in arrest cases.

Keywords: Cardiopulmonary resuscitation, education, return of spontaneous circulation

ÖZ

Amaç: Kardiyak arrest, acil servislerde görülen mortalitesi yüksek klinik olayların başında gelir. Bu çalışmanın amacı, eğitimin hastane dışı ve hastane içi kardiyak arrest hastalarında uygulanan kardiyopulmoner resüsitasyonun (KPR) kalitesi üzerindeki etkisini değerlendirmek ve Spontan Dolaşımın Geri Dönüşü (ROSC) üzerine etkisini incelemektir. **Gereç ve Yöntem:** Bu çalışma Gülhane Eğitim ve Araştırma Hastanesi Acil Servisinde yapıldı. Kardiyopulmoner arrest hastalarının verileri "Resüsitasyon Takip Formu" kullanılarak toplandı. Erişkin arrest vakalarının demografik verileri CPR parametreleri toplanarak tanımlayıcı veriler elde edildi. Eğitim öncesi ve sonrası ROSC ve CPR yönetimi parametreleri karşılaştırıldı. **Bulgular:** Çalışmaya toplam 95 hasta dahil edildi. Hastaların yaş ortalaması 69,16±14,606 idi. Hastaların %64,2'si (n=61) eğitim öncesi, %35,7'si (n=34) eğitim sonrası müdahale edilen kardiyak arrest hastalarıydı. Arrest hastalarda eğitim öncesi ROSC oranı %36,1 iken, eğitim sonrası %38,2 idi. Eğitim öncesi ve eğitim sonrası gruplar ROSC açısından karşılaştırıldığında, eğitim sonrasında ROSC oranlarının arttığı görüldü. EtCO2 kullanım oranı eğitim öncesi olgularda %3,3 (n=2) iken, eğitim sonrası olgularda bu oran %97,1 (n=33) oldu. EtCO2 kullanım oranı eğitimle anlamlı olarak arttı (p=0.001).

Sonuçlar: Eğitim sonrası EtCO2 kullanımı ve doğru ilaç uygulamasının arttığı görüldü. Tekrarlı eğitimlerin arrest vakalarda CPR yönetimini iyileştirdiği saptandı.

Anahtar Kelimeler: Kardiyopulmoner resüsitasyon, eğitim, spontan dolaşımın geri dönüşü

Introduction

The absence of signs of breathing and circulation resulting from the sudden and unexpected cessation of the heart's pumping function is defined as cardiopulmonary arrest (CPA), and the resulting death is defined as sudden cardiac death (1). The main clinical findings seen in CPA patients can be considered impaired consciousness, respiratory arrest, and pulselessness (2, 3). CPA is one of the clinical conditions with the highest mortality rate in the emergency department (4). The non-traumatic cardiac arrest rate of the CPA patients admitted to the ED was 80-90%, and the traumatic arrest rate was reported as 12-13% (5). According to the place of occurrence, CPA can be classified into two main groups, in and out of the hospital. Cardiopulmonary resuscitation (CPR) is a whole of basic and advanced life support applications applied to patients inside or outside the hospital in cases with CPA development. The most critical factors for the Return of Spontaneous Circulation (ROSC) in patients are the early diagnosis of cardiac arrest, early CPR, and rapid defibrillation (6). After that, appropriate post-resuscitation care increases the patient's neurological survival and ensures that one can return to their social life by discharge. For this purpose, periodic guidelines are being published (7).

One of the most important issues highlighted in current CPR guidelines is the uninterrupted application of chain of life rings in CPA cases. Adult life chain steps in resuscitation can be summarized as I. Calling for help, ii. Starting cardiac massage, iii. Applying electrical therapy, iv. Transporting to the appropriate center in the early period, v. Providing care in optimal intensive care conditions (7). According to the current guidelines, the training must be repeated frequently. However, time, space, and instructor constraints are essential issues for training in this field to be given optimally to different groups of medical personnel (such as physicians, nurses, emergency medical technicians (EMT), paramedics, etc.). Another issue area is the inability to perform adequate training. The recent COVID-19 pandemic has also not allowed face-to-face training in terms of contact isolation and emphasized the importance of online training (8).

The emergency physician and nurse provide the first response to CPA in the emergency department. CPR training aims to diagnose the patient early, recognize arrest rhythms early, and gain the skills to apply the basic and advanced life support steps quickly and accurately. Studies have revealed that online training can be helpful and improve CPR quality (9). This study's primary outcome: This study investigates the effect of an online and targeted repetitive education systems on CPR quality in the tertiary emergency department. Secondary outcomes: to investigate whether online training contributes to the standardization of teamwork and personnel practices in the CPR process and other factors that affect the return of spontaneous circulation.

Materials and Methods

The study is designed as a prospective observational study in the emergency department of a tertiary university hospital. The local Ethics Committee approved our study (March 25, 2021, approval number 2021/123.

The patients' demographic data (age and gender) and their comorbidities (diabetes mellitus, hypertension, chronic renal failure, chronic obstructive pulmonary disease, malignancy, asthma) were first questioned, and the cases were gathered with the Utstein style data form and descriptive observational data were obtained (10). All adult patients who underwent CPR in the emergency department were included. The study did not include patients with incomplete data, patients under 18, patients with traumatic cardiac arrest, and pregnant patients.

According to the place of emergence, cardiac arrest is classified as in-hospital and out-of-hospital, and the time to intervene is recorded if there are witnesses. In cases of CPA with out-of-hospital cardiac arrest (OHCA), EMS team formations, time to arrive at the scene, the first rhythm seen in the patient, the first medical intervention and airway clearance (airway/LMA/intubation), whether defibrillation or cardioversion was performed according to the rhythm observed on the monitor, the medications administered were recorded.

For the in-hospital cardiac arrests (IHCA), the location of the arrest (Trauma room/emergency room/CT/MR/elevator), initial rhythm observed on the monitor during CPR, the time of intubation, and whether etCO2 monitoring was performed were recorded. Defibrillation, cardioversion, pacemaker, and mechanical chest compression device use status were also recorded. Peripheral vascular access, central catheter, and intraosseous catheter placement have been questioned. Medications (epinephrine, calcium, sodium bicarbonate, insulin, amiodarone, magnesium) and IV fluids administered during CPR were recorded.

Spontaneous circulation was expected to continue for 20 minutes to exclude cases of recurrent arrest in patients with a pulse after CPR (11). Patients who were provided with ROSC were followed up for their further prognosis.

Blood gas analysis results, routine biochemistry values (blood glucose, renal function tests, sodium, potassium, CRP (C- Reactive Protein), cardiac markers, INR, D-dimer), and complete blood count (CBC)

parameters were recorded in routine blood tests taken from patients. No supplementary biochemical procedures were explicitly performed for the study.

Two online pieces of training were planned for the study, and the data gathered during the study were divided into two groups: pre-training and training. An emergency service resuscitation follow-up form was created with all the parameters listed above, and the same form was used in pre- and post-education evaluations. Changes in practice in resuscitation management after training in the parameters examined were evaluated. Statistical analysis of the data obtained and the effect of online and targeted repetitive training on CPR quality were investigated. Secondarily, it was investigated whether the training contributed to the standardization of the personnel practices through teamwork during the CPR process. These trainings aim to highlight the algorithms taken from the current guidelines for CPR. The first training was given online on April 12, 2021, via zoom to nurses and emergency physicians actively involved in CPR. The trainings given were recorded. On May 28, 2021, emergency physicians and nurses who participated in the first training via zoom were given second online training. In these trainings, the information highlighted in the current guidelines is emphasized. The training content is prepared according to the AHA 2020 guideline.

Statistics analysis

In the power analysis, it was calculated that a total of 55 patients would be sufficient when the current ROSC rate is taken as 32%, the expected ROSC rate as 50%, the alpha value as 0.005%, and the power as 80% (5, 12). Due to possible data deficiencies, it was decided to take 95 patients into the study. The continuous data were given as frequency, percentage, mean, and standard deviations. The normal distribution of the data was evaluated by the Kolmogorov-Smirnov test. If it revealed a normal distribution, the comparison was conducted by Student's t-test; if it did not reveal a normal distribution, it was carried out with a Mann-Whitney U test. Chi-Square test was used to compare the two groups for categorical variables. The significance was evaluated at a $p<0.05$ level. The data was analyzed using the IBM SPSS 22.0 statistical package program.

Results

A total of 95 patients were included in the study, and 69.5% (n=66) of the patients were male, and 30.5% (n=29) were female. The mean age of the patients was 69.16±14.6. Demographic data of the patients included in the study are summarized in **table 1.**

Table-1. Demographic data

Parameter	Mean ±Standard Deviation or n (%)
Age	69.16±14.6
Gender	
Female	29 (%30.5)
Male	66 (%69.5)
Comorbidities	
None	16 (%16.8)
DM	24 (%25.3)
HT	37 (%38.9)
CRF	10 (%10.5)
COPD	7 (%7.3)
Malignancy	16 (%16.8)
CAD	8 (%8.4)
Asthma	1(%1.1)
Pacemaker	
With the Pacemaker	6 (%6.3)
Prognosis	
ROSC in the Emergency Department	32 (%33.6)
Exitus in the Emergency Department	63 (%66.3)
Total	**n=95** (%100)

Abberivations: DM: Diabetes Mellitus, HT: Hypertension, CAD: Coroner Arter Disease CRF: Chronic Renal Failure, COPD: Chronic Obstructive Pulmonary Disease

Out-of-hospital arrest patients accounted for 52.6% (n=50) of the total patients. Among these, 12% (n=6) had been arrested in the ambulance. The initial arrest rhythm in patients with Out-of-hospital CPA was 92% (n=45) as asystole. The findings of out-of-hospital arrest patients are summarized in **table 2.**

Table-2. Demographic data of pre-hospital arrest patients.

Arrest Location	
Pre-Hospital	50 (%100)
-Ambulance	6 (%12)
-Out of Hospital	44 (%88)
Arrest Time	
08.00 – 18.00	27 (%54)
18.00 – 24.00	17 (%34)
24.00 – 08.00	6 (%12)
Arrest Type	
Nontraumatic	48 (%96)
Traumatic (fall)	2 (%4)
Witnessing the arrest	
Witnessed	22(%44)
Not witnessed	28(%56)
Witness Intervention	
No intervention	37 (%74)
CPR performed	2 (%4)
CPR and respiratory support	11 (%22)
First Arrest Rhythm	
Asystole	46 (%92)
VT	0 (%0)
VF	1 (%2)
PEA	3 (%6)
First 112 intervention	
CPR performed	48 (%96)
CPR not performed	2 (%4)
Airway management of 112 team	
Airway	29 (%58)
LMA	14 (%28)
Intubation	7 (%14)
Surgery	0 (%0)
Defibrillation by 112 team	
Scoop	1 (%2)
Cardioversion by 112 team	
Cardioversion performed (Pad)	1 (%2)
Pre-Hospital Vascular Access	
Peripheral Vascular Access	43 (%86)
No Vascular Access	7 (% 14)
Total patients	n=50

Aberivations: 112: Emergency Call Center of Turkey, 112 Team Formation: Doctor, Nurse, Paramedic, Emergency Medical Technician, VT: Ventricular Tachycardia, VF: Ventricular Fibrillation, PEA: Pulseless Electrical Activity, CPR: Cardiopulmonary Resuscitation, LMA: Laryngeal Mask

A total of 45 patients were included in the study, 91.1% of whom had been arrested in the emergency room. The first arrest rhythm evaluated in 86.6% (n=39) is asystole. The first evaluation data of in-hospital cardiac arrest patients is given in **table 3**. 64.2% (n=61) of the patients included in the study were pre-training arrest patients, and 35.7% (n=34) were post-training patients. In these patients, post-training ROSC incidence was 38.2% (n=13) and observed to increase. However, this difference was not statistically significant. $etCO_2$ usage rate is 3.3% (n=2) in pre-training cases, compared to 97.1% (n=33) in post-training cases. $etCO_2$ usage rate increased significantly with training (p 0.001). $etCO_2$ was used in patients both to evaluate the accuracy of the location of the intubation tube and to evaluate the quality of CPR. Comparison data on cardiac arrest applied before and after training of patients are summarized in **table 4.**

Once the vascular access is provided during CPR, the epinephrine should be initiated to be administered 1 mg every 3 to 5 minutes. In our study, it was observed that there was an improvement in the correct epinephrine

timing after the training. While epinephrine administration time was correct in 20 (32.7%) of 57 cases pre-training, it was correct in 18 (52.9%) of 34 cases post-training. CPR management is carried out only by physicians. However, after the training of the nurses, the deficiencies during drug administration were eliminated. After the epinephrine administration to all patients in the post-training term, their extremities were positioned, and 10 cc saline was administered as a flush.

Table-3. In-hospital arrest patients.

Arrest Location	
Emergency Department observation units	41 (%91.1)
Ultrasound room	1 (%2.2)
Computed Tomography	2 (%4.4)
Elevator	1 (%2.2)
Arrest Time	
08:00 - 18:00	27(%60)
18:00 - 24:00	12(%26.6)
24:00 - 08:00	6(%13.3)
First Arrest Rhythm	
Asystole	39(%86.6)
VT	0
VF	3(%6.6)
PEA	3(%6.6)
Total Patients	n=45

Abberivations: VT: Ventricular Tachycardia, VF: Ventricular Fibrillation, PEA: Pulseless Electrical Activity

Table-4. Comparison of pre-training and post-training practices on patients with CPR in the emergency department.

	Pre-training (n=61)	**Post-training (n=34)**	**p**
ROSC/Total CPA	22/61 (36.1%)	13/45 (38.2%)	0.829
etCO_2	2 (3.3%)	33 (97.1%)	0.001
Defibrillation	17 (27.9%)	6 (17.6%)	0.324
Exitus in the Emergency Department	41 (67.2%)	22 (64.7%)	0.824

Abberivations: ROSC: Return of Spontaneous Circulation, EtCO_2: End Tidal Carbon Dioxide

Table-5. Comparison of pre-training and post-training medications administered during CPR.

	Pre-Training (n=61)	**Post-Training (n=34)**	**p**
Atropine	8 (13.1%)	1 (2.9%)	0.149
$NaHCO_3$	26 (42.6%)	15 (44.1%)	0.100
Ca	18 (29.5%)	12 (35.2%)	0.725
Mg	0 (0%)	2 (5.8%)	0.560
Amiodarone	8 (13.1%)	6 (17.6%)	0.559
Insulin	8 (13.1%)	8 (23.5%)	0.310
Norepinephrine	5 (8.1%)	2 (5.8%)	1.000
Normal saline solution	61 (100%)	34 (100%)	N/A (not applicable)
Dextrose (5% Dx, 500 cc)	7 (11.4%)	7 (20.5%)	0.05

Medication administrations for pre-training arrest patients covering 64.2% (n=61) of the patients included in the study, were compared with post-training arrest patients covering 35.7% (n=34). The administered medications are presented in **table 5.** Although routine atropine application is not included in the up-to-date guidelines in CPR application, it was observed that it was applied to 8 patients from 61 patients before training. The number of patients administered atropine was seen in 1 out of 34 patients after the training, and unnecessary application of atropine was largely prevented. However, this value is not statistically significant and is p=0.149. Another medication evaluated during CPR is amiodarone. Amiodarone was administered to a total of 14 patients before and after training. Pre-training amiodarone administration was 13.1% (n=8), compared to 17.6% (n=6) post-training. The training increased the rate, but there was no statistically significant difference (p=0.559). Before the training, amiadoron was given in saline in a few patients, while

after the training, it was administered to all patients as an intravenous push. When CPR medication administrations were evaluated, it was observed that no Mg was administered to any patients before training. As a result of rhythm analyses performed during CPR, the monitor rhythm was evaluated as torsades de pointes, and Mg was added to the treatment in 2 patients.

Discussion

Enabling ROSC in CPA patients, instead of CA development, varies according to whether the arrest is witnessed, the first intervention, the time it takes to reach the hospital, other diseases of the patient, and the medications they use. In our study, we evaluated that targeted, recurrent, online CPR training improved the management quality of arrest cases and achieved clinically positive results. 69.5% of the patients included in the study were male, and 30.5% were female. Berdowski et al. stated that the rate of the male was higher in cases brought as arrests (13). In the studies conducted by Bertoia et al. and Adabag et al., they found that the rate of the male was 2-3 times higher than females in non-hospital arrest cases. These studies stated that estrogen has a protective effect on the cardiovascular system during the premenopausal period (14, 15). In our study's data, as in the studies of Berdowski et al., Bertoia et al., and Adabag et al., it was observed that the male gender was more common in arrest cases admitted to the hospital. These data were found to be similar to the literature. The mean age of the patients who underwent CPR in the study was 69.1 ±14.6 In the study of Van Gijn MS et al., the mean age of cardiac arrest patients was found to be between 60-75 years, which was evaluated in line with our study (16). 16.8% of the patients in our study did not have any comorbidities. When the comorbidities of the patients participating in the study are evaluated, the most common is HT, followed by DM, malignancy, CRF, and CAD. In a study by Isenschmid et al., when the comorbidities of 321 patients with cardiac arrest were examined, CAD and diabetes mellitus were observed most frequently, and CRF and malignancy were observed less frequently (17). In a series of cardiac arrest studies conducted by Geçmen et al. in a tertiary center, HT and DM were most common in patients, followed by CRF, CHF, CAD, and COPD (18). In our study, the rate of comorbid disease is high in arrest cases, similar to the literature. It has been evaluated that the differences between comorbidities are because the studies are conducted in different populations and different geographical regions.

In our study, 92% asystole and 6% PEA were observed as the first arrest rhythm in OHCA patients. According to Bayes et al.'s study, the basic rhythm was VF, and pulseless VT is approximately 25-35% of out-of-hospital sudden cardiac arrests. In comparison, PEA was observed in approximately 25% of the patients. Bradyarrhythmia and asystole are reported as less common (19). In a study on sudden cardiac death by Katristis et al., it was reported that the incidence of VF or pulseless VT as the first arrest rhythm in OHCA decreased below 30% (20). PEA and asystole are more common in OHCA (20). According to the study of Myerburg et al., the incidence of PEA as the first arrest rhythm in OHCA was found to be 19-23% (21). We think that the reason for the higher incidence of asystole in our study may have changed from a shockable rhythm or PEA to asystole because of the recognition of out-of-hospital arrest, the delay in the intervention due to lack of training in the witnessed arrest, the time to reach emergency call center team, and the delayed access to the AED.

Although 74% of OHCA patients were witnessed, CPR was not initiated, and chest compressions are recommended in the case of CPA regardless of the sociocultural level (22). Neumar et al.'s study suggest that chest compression significantly increases the survival rate (23). For this reason, we think that CPR training should be given to citizens other than healthcare workers. In OHCA patients brought by EMS teams, it was observed that airway was applied in 58% of patients, and LMA was applied in 28%. In a study published in 2018 comparing patients with endotracheal intubation (ETI) and balloon mask (BVM) in 2040 OHCA patients, no statistically significant difference was found between ETI and BVM in terms of 28-day neurologic survival (24). Since the average time to reach the hospital is 12-20 minutes, we think it aims not to waste time with ETI by prioritizing chest compressions by EMS teams.

Studies have shown that blood pressure changes during the day in healthy individuals, and the incidence of myocardial infarction increases in the morning is associated with increased catecholamine levels in addition to increased blood pressure and increased platelet aggregation in the morning (25). Increasing blood pressure with the circadian rhythm leads to the deterioration of atherosclerotic plaque stability in the coronary arteries and myocardial infarction, with the increase in cardiac sympathetic activation triggered by the catecholamine level (26). Increased sympathetic stimulation in the morning due to circadian rhythm increases the risk of MI

and the incidence of arrest associated with it (27). In our study, per these data, it was observed that the most common arrest development time of the patients was between 08:00 am and 6:00 p.m.

In 9% of the patients who developed IHCA included in the study, arrest developed in areas out of treatment service. These are the patients who are followed up in the emergency department and planned for transport due to the need for imaging and further examination. 3 of these 4 patients in whom CPR application was started outside the emergency department were provided with ROSC. We think that monitoring these patients during transport, early recognition of the arrest rhythm and the experience of the healthcare personnel accompanying the patient increase this rate. In our study, patients with in-hospital arrest were divided into two groups: pre-training and post-training, and it was observed that the ROSC rate increased by 38.2% after training. Although the ROSC rate increased after the training, this difference was not statistically significant (p=0.829). When the studies of Toubasi et al. and Nil Kaan et al. were examined, it was found that the quality of CPR increased after the basic life support-defibrillation course given interactively (28, 29). However, these studies were carried out on manikins, and ROSC was not evaluated in the study. In our study, the post-training mortality rate was 64.7%, which decreased but was not statistically significant. We think that the referral of patient groups with high comorbidity through the prehospital emergency medicine system caused the reduced ROSC rate.

In the study, the use of capnography was evaluated in evaluating $etCO_2$ before and after the training. Post-training $etCO_2$ use increased significantly (p=0.001). $etCO_2$; reflects alveolar CO_2 pressure, production, and cardiac output in the general (30). In a series of three cases reported in 1977, Schoonees first suggested that $etCO_2$ monitoring with a capnography may be an early indicator of ineffective cardiopulmonary resuscitation, emphasizing the need for further studies on this issue (31). The $etCO_2$ measured during CPR reflects the cardiac output generated during chest compressions. It has been reported that $etCO_2$ cannot be used alone for the decision to terminate CPR, but if the 20-min $etCO_2$ value is <10 mmHg, the probability of developing ROSC is low (32). The usage of capnography was analyzed before and after training in our study as an application used during CPR and the frequency of use. Although the usage of capnography, which is considered a quality indicator, rose after schooling, there was no influence on ROSC.

In patients undergoing CPR, administration of 1 mg epinephrine is recommended as soon as vascular access is established and repeated every 3-5 min until ROSC is achieved (33). The amount of epinephrine used in the Wang et al. study was 8.1±7.1 mg (34). In the study of Tezcan Keleş et al., who evaluated IHCA cases, the amount of epinephrine administered was found to be 7.63±3.1 mg (35). When we grouped our patients as pre-training and post-training, the average amount of adrenaline before the training was 9.24 mg, and the amount of epinephrine after the training was 7.91 mg. The amount of epinephrine administered in the study was compatible with the literature.

In our study, another medication administered during CPR and whose frequency of administration was evaluated before and after training is amiodarone. Amiodarone is a membrane-stabilizing medication. It is used in refractory VF and VT (33). In our study, it was administered to 14.7% of the patients. This rate was 13.1% in the pre-training group and 17.6% in the post-training group. In the study of Laina et al. investigating the effects of amiodarone use on survival and neurological recovery in patients with CPA, it has been found that amiodarone increases survival but does not have a significant benefit in the neurological recovery (36).

Study limitations

There were certain limitations to this study. First, the single-center study was identified as a research limitation. Another limitation is the lack of training for the EMS staff that respond to OHCA patients. Evaluation of the training provided was done using the emergency department resuscitation follow-up form, however no individual standardized test was performed after the training.

Conclusions

It was evaluated that although repeated training did not statistically reflect the success of ROSC, it increased the quality of management of arrest cases, and clinically positive results were obtained. After the training, end-tidal carbon dioxide monitoring, which shows the quality of cpr, increased. The rate of correct use of epinephrine and amiadoron was found to be increased. To improve the quality of CPR and increase the success of ROSC, it was evaluated that it is necessary to provide repetitive training to the healthcare teams who intervene in prehospital cardiac arrest, which is one of the essential elements of the survival chain.

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