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CARDIOPULMONARY RESUSCITATION TRAINING IMPROVES THE QUALITY OF BASIC LIFE SUPPORT PROVIDED BY UNTRAINED RESCUERS WITH DISPATCHER GUIDANCE

Kardiyopulmoner Resüsitasyon Eğitimi Eğitimsiz Kurtarıcıların Acil Yanıt Sistemi Görevlisi Kılavuzluğunda Uyguladığı Temel Yaşam Desteğinin Kalitesini Artırmaktadır

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ABSTRACT

Objective: The people who aid patients in cardiac arrest in daily life are those who witness the event in the immediate environment. In cases of cardiac arrest, which anyone can encounter at any time and place, the application of correct and efficient basic life support by bystanders contributes significantly to the patient's survival. In this study, our aim was to compare the efficiency of cardiopulmonary resuscitation (CPR) by untrained lay rescuers assisted by a dispatcher with CPR by the same persons without assistance from a dispatcher after they are provided with CPR training.

Material and Methods: We planned the study prospectively on 5th year students of the Baskent University Faculty of Dentistry. We placed each study participant one by one in a room where there was a model of basic life support (BLS) and a CPR feedback device. We provided participants with a scenario of BLS taking place in a public space. At that time, we contacted a dispatcher who was standing in another room. We asked participants to apply one 2-min cycle of CPR consisting only of chest compression with the dispatcher's assistance. After we recorded data on all participants, we provided them BLS training. We re-evaluated all participants' CPR abilities immediately after this.

Results: Thirty-seven 5th year Faculty of Dentistry students participated in our study. The median age of participants was 23.22±1.31. The gender distribution was 16.2% male and 83.7% female. There was a statistically significant difference between the number of chest compressions applied before (89.27±24.53) and after training (110.59±21.92) (p <0.001). There was a statistically significant difference between the measurements of compression times, the ratio of proper compressions to all compressions, and the compression percentages before and after training (p <0.005; <0.005 and <0.001 respectively).

Conclusion: The results of our study clearly reveal that the CPR applied by trained laypersons is distinctly superior to CPR with the assistance of a dispatcher.

***Keywords**: Basic life support, cardiopulmonary resuscitation, training*

ÖZ

Amaç: Hastane dışında kardiyak arrest gelişen bir hastaya ilk yardım edebilecek kişiler, o anda yakın çevrede olaya tanık olan insanlardır. Her an her yerde hepimizin karşılaşabileceği kardiyak arrest durumlarında olaya tanık olan kişilerin doğru ve etkili temel yaşam desteği uygulamalarının, hastanın sağ kalımına önemli katkı sağladığı bildirilmiştir. Bu çalışmada daha önceden kardiyopulmoner resüsitasyon (KPR) eğitimi almadığı bilinen kurtarıcıların acil yanıt sistemi görevlisi yönlendirmesi yapmış oldukları KPR'nin etkinliğini; aynı kişilere KPR eğitimi verdikten sonra acil yanıt sistemi görevlisi olmaksızın yapılanla karşılaştırmayı amaçladık.

Gereç ve Yöntemler: Çalışmayı Başkent Üniversitesinde, Diş Hekimliği Fakültesi 5. sınıf öğrencileri üzerinde prospektif olarak gerçekleştirdik. Katılımcıları tek tek temel yaşam desteği maketinin ve KPR geri bildirim cihazının bulunduğu salona aldık. Katılımcılara, halka açık alanda gerçekleşen bir temel yaşam desteği senaryosu verdik. Bu esnada mobil telefonla başka bir odada hazır bekleyen acil yanıt sistemi görevlisi ile telefon bağlantısı kurduk. Katılımcıların acil yanıt sistemi görevlisinin yönlendirmesi ve tarifiyle 1 kez, 2 dakikalık, yalnızca göğüs kompresyonlarından oluşan KPR yapmasını istedik. Tüm katılımcıların eğitim öncesindeki verilerini KPR geri bildirim cihazıyla kaydettikten sonra hepsine temel yaşam desteği eğitimi verdik. Eğitimden hemen sonra da tüm katılımcıların KPR becerilerini yeniden değerlendirdik.

Bulgular: Çalışmamıza ortalama yaşı 23.22±1.31 olan 37 öğrenci katıldı. Katılımcıların %16.2'si erkek, %83.7'si kadındı. Göğüs kompresyon sayıları bakımından, eğitim öncesi (89.27±24.53) ve sonrası (110.59±21.92) ölçümlerde eşleştirilmiş t-testi ile yapılan değerlendirmeye göre istatistiksel olarak anlamlı fark mevcuttu (p <0.001). Bunun yanı sıra eğitim öncesi ve sonrası ölçümlerde kompresyon zamanları, doğru kompresyonların tüm kompresyonlara oranı ve kompresyon yüzdeleri arasında istatistiksel olarak anlamlı fark mevcuttu (sırasıyla p <0.005; <0.005 ve <0.001).

Sonuç: Çalışmamızın sonuçları eğitim almış halktan kurtarıcıların uyguladığı KPR'nin, acil yanıt sistemi görevlisi aracılığıyla yapılandan belirgin olarak daha üstün olduğunu ortaya koymuştur.

***Anahtar Kelimeler**: Temel yaşam desteği, kardiyopulmoner resüsitasyon, eğitim*

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INTRODUCTION

The people who aid patients in cardiac arrest in daily life are those who witness the event in the immediate environment. Bystanders may be close relatives of the patient; they may also be neighbors or strangers. In cases of cardiac arrest, which anyone can encounter at any time and place, the application of correct and efficient basic life support by bystanders contributes significantly to the patient's survival (1). The 2015 Basic Life Support and Emergency Cardiovascular Care Guidelines describe the training of lay rescuers, those who are not healthcare personnel, as an important goal to be reached (2). The 2015 guidelines also recommend only maintaining chest compression by untrained lay rescuers (with or without the assistance of a dispatcher) until the support of educated rescuers arrives (Class I recommendation, Level of Evidence C-LD) (3). The above-mentioned dispatcher, the officer working at the immediate medical response systems such as 122 or 911, is well trained and can guide rescuers in basic life support by phone. Cariou et al. reported that cardiopulmonary resuscitation (CPR) training programs attended by dispatchers are one of the important strategies for the survival of cardiac arrest patients (4). Despite all education efforts, it is stated that bystanders in the United States initiate CPR in only 30% of cardiac arrest cases in the out-of-hospital setting (5). This rate was found to be 13.2% by Cho et al. in Korea, corresponding to one third of the cardiac arrests witnessed (6). In our country, however, CPR with the assistance of a dispatcher has not been implemented, and the need for this has recently been brought to light.

In view of these data, studies are required that reflect the situation in our country, as well as those evaluating the efficiency of CPR with the guidance of a dispatcher and with the presence of a CPR feedback device. In this study, our aim was to compare the efficiency of CPR by untrained lay rescuers assisted by a dispatcher with CPR by the same persons without assistance from a dispatcher after they are provided with CPR training. Moreover, if we consider that the first condition of successful basic life support is training, although every single person in the country cannot be trained individually, we aimed to determine the level of contribution of dispatchers–those who can guide every related individual efficiently–to basic life support. In order to evaluate these data objectively, we planned to use one of the CPR devices with auditory and visual feedback, which is recommended as a Class 2B proposal by the current guidelines for the optimization of the real-time CPR (3).

MATERIALS AND METHODS

We obtained approval for the study (KA 16/355) from the Medical and Health Sciences Research Committee of Başkent University, Ankara, Turkey. We also obtained written informed consent from the participants. We planned the study prospectively on 5th year students of the Başkent University Faculty of Dentistry.

Inclusion criteria:

1. Being a 5th year student of Baskent University Faculty of Dentistry
2. Accepting to take part in the study
3. Signing the informed consent form

Exclusion criteria:

1. Having previously taken basic life support training
2. Not accepting to take part in the study
3. Not signing the informed consent form
4. Not completing the study

We placed each study participant one by one in a room where there was a model of basic life support and a CPR feedback device. We provided participants with a scenario of basic life support taking place in a public space. At that time, we contacted a dispatcher (assistant professor of emergency medicine) who was standing in another room. The dispatcher guided participants in line with the recommendations and sample phone

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conversations of the American Health Association (7). We asked participants to apply one 2-min cycle of CPR consisting only of chest compression with the dispatcher's assistance. In order to record the participants' CPR performances, we allowed them to use the CPR feedback device. After we recorded pre-training data on all participants, we provided them with 2 h of theoretical and practical basic life support training. We re-evaluated all participants' CPR abilities immediately after this training. This time, participants were considered as trained, and we asked them to apply one 2-min cycle of CPR consisting only of chest compression without the assistance of the dispatcher. We analyzed the data collected by the CPR feedback device by means of SPSS for Windows 17.00.

Devices

We used Adam CPR™ (Simulaids Inc, Woodstock, New York, USA) as an adult CPR training model in our study. We used TrueCPR™ (Physio-Control, Redmond, Washington, USA) as a CPR feedback device. This CPR feedback device could record the number of chest compressions, the compression-ventilation times and percentages, how many of the chest compressions applied by rescuers were between 5 and 6 cm deep, and how many of the releases were complete.

Statistical analysis

We tested the distribution of the data recorded by the CPR feedback device for normality by means of a Kolmogorov-Smirnov test. We tested normally distributed data by using a paired-samples *t*-test, as there were two dependent groups. We implemented a Wilcoxon signed-rank test for non-normally distributed data. We evaluated the correlation between the participants' body mass indexes and the compression parameters before and after training by employing a Pearson correlation test. Results were considered statistically significant at $p < 0.05$.

RESULTS

Thirty-seven 5th year Faculty of Dentistry students participated in our study. The median age of participants was 23.22±1.31. The gender distribution was 16.2% (n=6) male and 83.7% (n=31) female. The participants' average body mass index was 20.9 ± 2.2.

We determined that 32 (86.4%) participants applied compressions properly and 5 (13.5%) participants applied misplaced compressions before receiving training. After training was completed, however, all participants applied correctly placed chest compressions. Only the numbers of chest compression per minute applied by participants before and after training were normally distributed. The remaining evaluated parameters–the ratio of proper compressions to all compressions, the ratio of proper releases to all releases, and compression percentages–did not present a normal distribution. According to the evaluation of matched pairs of measurements carried out by using a paired-samples t-test, there was a statistically significant difference between the number of chest compressions applied before (89.27±24.53) and after training (110.59 ± 21.92) ($p < 0.001$). In Table 1, we summarize the results of the Wilcoxon signed-rank test of non-normally distributed data. There was a statistically significant difference between the measurements of compression times, the ratio of proper compressions to all compressions, and the compression percentages before and after training.

There was a weak positive correlation between the body mass indexes of the participants and their compression ratios before and after training as well as their compression numbers (r = 0.367, 0.448, and 0.332, respectively). There was a weak negative correlation between participants' body mass index and their release ratios after training (r = −0.389).

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Table 1. Comparison of compression time, compression ratio, release ratio, and compression percentage before and after training.

Parameter	Before Training	After Training	*p*
Compression Time seconds	122 (4)	120 (1)	<0.005
Compression Ratio	0 (0)	2 (14)	<0.005
Release Ratio	100 (4)	98 (24)	0.157
Compression Percentage	99 (3)	100 (0)	<0.001

* Data are expressed as median (interquartile range; IQR).

DISCUSSION

The results of our study clearly reveal that the CPR applied by trained laypersons is distinctly superior to CPR with the assistance of a dispatcher. During our study, we observed that training, even that of short duration, is useful not only for applying efficient CPR parameters but also for applying compressions to the correct location with proper positioning of the hands, elbows, arms, and whole body. The positive results of CPR education beginning at primary school age over the past 15 years in Denmark, a European Union member country, were highlighted in a study by Viereck et al. The authors reported that bystander rescuers started CPR with the assistance of a dispatcher in 65% of out-of-hospital cardiac arrest cases in daily life (8). However, this situation was not associated with 30-day survival.

In agreement with our study, the quality of CPR applied by trained rescuers was found to be significantly higher than that of CPR administered with the assistance of a dispatcher in a recently published study by Paton et al. Moreover, the rate of compressions applied to an improper place was found to be 13.5% in our study and 7.89% by Paton et el. (9). Consequently, the authors emphasized the importance of CPR education for lay rescuers. Sun Ro et al. have shown that in cases of cardiac arrest at home, in orphanages, and in dormitories, CPR with assistance from a dispatcher was associated with better neurologic outcomes for patients (10). We also think that CPR applied after CPR education is of higher quality than CPR administered with the assistance of a dispatcher. However, given that neurological benefits were presented, we believe that applying CPR with the assistance of a dispatcher would be more beneficial than no action at all in the face of a cardiac arrest.

Other authors have stated that initiation of CPR can be delayed for a given time for the guidance and instruction of the dispatcher in the case of CPR with the assistance of a dispatcher (11). When we designed our study, we did not plan to measure this. However, we sought answers to questions normally posed on the phone such as the address of the event, evaluation of unresponsiveness of the patient and verification that the patient and rescuer were in a safe place and the patient was laying on a flat surface. We observed that the average time required accomplishing these and to give CPR instructions was approximately 1 min. This translated to a 1-min delay in initiating CPR. Under the circumstances, it is clear that when a trained rescuer encounters an unresponsive patient, beginning CPR while at the same time activating the immediate response system will bring better results.

In conclusion, there are actions to be taken to restore an arrest patient to life by means of high-quality CPR (4). We consider that basic life support education must be provided starting at primary school age, and this education must be repeated in order to increase the participation rate of witnesses in CPR. Of course, these education processes should not be limited to the training of lay rescuers; dispatchers must also have the required information to always be ready to guide a layperson in treating a cardiac arrest patient by phone or video. For this purpose, health policy makers should design the number and frequency of CPR education sessions for both dispatchers and the public.

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Limitations

We conducted our study by using a mannequin instead of real patients. This brings some differences resulting from differences in the physical specifications between a plastic object and a real human being. The participants we included in our study were dentistry faculty students. Although they did not have prior CPR education, because they are healthcare personnel, they were not completely unfamiliar with the issue. This is one of the limitations of our study. The model we used did not have the ability to exhibit CPR parameters. Therefore, we could only record data by means of a feedback device. We monitored the participants immediately after they received education. Their knowledge was recently acquired; therefore, we could not determine how the quality of CPR would be after some time had passed. These issues should be considered in future studies on this topic.

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