ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA MAKALESİ

Assesment of the Knowledge and Skills of Paramedics Working in Prehospital Health Services on Making a Decision for and Applying Defibrillation and Cardioversion

Hastane Öncesi Acil Sağlık Hizmetlerinde Görev Yapan Paramediklerin Defibrilasyon, Kardiyoversiyon Uygulama Kararı Alma ve Uygulama Konusundaki Bilgi-Beceri Düzeylerinin Değerlendirilmesi

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ABSTRACT

Aim: The aim of the present study was to investigate the knowledge level and skills of paramedics working in prehospital 112 emergency medicine health services in the Konya province on making a decision for and applying defibrillation and cardioversion.

Material and Methods: Sixty-two paramedics working for the prehospital 112 emergency medicine health services in Konya province were included in this cross-sectional study. The data were collected through personal data form and the defibrillation and cardioversion application assessment observation form developed by the researcher.

Results: Of the paramedics, 90.3% were determined to have been diagnosed with ventricular fibrillation within the first 10 seconds and 90.4% were determined to have made a decision for defibrillation within the first 10 seconds. Of the paramedics, 58.1% were found to inquire regarding instability findings in patients who had ventricular tachycardia (VT) and whose pulses were palpable; 75.8% were found to have made a decision for applying cardioversion within the first 10 seconds, and 72% were found to activate the synchronous (SYNC) button. Differences were found in the selection of a proper energy value when the defibrillator electrodes were on the defibrillator and enabling safety/ warning steps during defibrillation and cardioversion applications.

Conclusion: It was concluded that paramedics are successful in recognizing rhythm, making a decision for defibrillation and cardioversion, and that simulation training improved the skills. On the other hand, the participants were seen to have insufficiencies at concurrent pulse and rhythm control, making a decision for starting cardio-pulmonary resuscitation, energy selection when the defibrillator electrodes were on the defibrillator and energy load when the defibrillator electrodes were on the patient, inquiring stability/instability findings, applying gel and enabling safety/warning during the cardioversion procedure.

Keywords: Paramedic, defibrillation, cardioversion, emergency medicine

ÖZ

Amaç: Bu araştırma Konya İli hastane öncesi 112 acil sağlık hizmetleri istasyonlarında görev yapan paramediklerin defibrilasyon, kardiyoversiyon uygulama kararı alma ve uygulama konusundaki bilgi- beceri düzeyini incelemek amacıyla yapılmıştır.

Gereç ve Yöntemler: Kesitsel tarama modeli ile yapılan araştırmaya Konya ili 112 acil sağlık hizmetlerinde görev yapan 62 paramedik dâhil edilmiştir. Verilerin toplanmasında araştırmacı tarafından oluşturulmuş kişisel bilgi formu, defibrilasyon ve kardiyoversiyon uygulama değerlendirme gözlem formu kullanılmıştır.

Bulgular: Paramediklerin %90,3'ünün ventriküler fibrilasyon ritmini 10 saniye içerisinde tanıdığı, %90,4'ünün ilk 10 saniyede defibrilasyon uygulama kararı aldığı saptanmıştır. Paramediklerin %58,1'inin monitörde ventriküler taşikardi ritminin gözlendiği ve nabız alınabilen hastada unstabilite bulgularını sorguladıkları, %75,8'inin ilk 10 saniyede kardiyoversiyon uygulama kararı aldığı, %72'sinin senkron (SYNC) tuşunu aktif hale getirdiği saptanmıştır. Defibrilasyon ve kardiyoversiyon uygulamalarında defibrillator elektrotları defibrilatör üzerindeyken uygun enerji seçimi ve güvenliğin sağlanması/uyarı basamaklarında farklılıklar saptanmıştır.

Sonuç: Araştırmadan elde edilen bulgular doğrultusunda paramediklerin ritim tanıma, defibrilasyon ve kardiyoversiyon uygulama kararı alma konusunda başarılı oldukları, simülasyon eğitimlerinin beceriyi artırdığı sonucuna varılmıştır. Defibrilasyon ve kardiyoversiyon uygulamalarında ritim ile eş zamanlı nabız kontrolü, kardiyopulmoner resüsitasyona başlama kararı, defibrilatör elektrotları defibrilatör üzerinde iken enerji seçimi ve defibrilatör elektrotları hasta üzerinde iken enerji yüklemesi; kardiyoversiyon uygulama sırasında stabil/unstabil bulguları sorgulama, jel sürme, ve güvenlik/uyarı sağlama basamaklarında eksiklikler olduğu görülmüştür.

Anahtar Kelimeler: Paramedik, defibrilasyon, kardiyoversiyon, acil tıp

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Introduction

Prehospital health services are high stress environments where decisions are made rapidly and sometimes with little knowledge and making a rapid diagnosis for critical patients is of vital importance for initiating an effective treatment. Hence, it is very important that the healthcare professionals who work in prehospital emergency services have the skills to make rapid decisions and apply proper interventions.

The first rhythm being ventricular fibrillation (VF) in sudden cardiac arrests (SCA) observed outside the hospital and not initiating treatment reduce the survival (1,2,3). Defibrillation is the most effective treatment method for ventricular fibrillation (VF), pulseless monoformic or polymorphic ventricular tachycardia (VT) (4,5). Cardio-pulmonary resuscitation (CPR), which is applied in prehospital SCA in the presence of two or more rescuers, prolongs the VF, delays the onset of asystole and widens the time window where defibrillation may develop. Therefore, the necessity of initiating CPR by one rescuer while another is controlling the rhythm and preparing for defibrillation has been emphasized (6,7,8). Synchronous cardioversion is indicated for arrhythmias that are unstable and lead to hemodynamic disorders. The shock in synchronous cardioversion is applied concurrently with the R wave in QRS complex on electrocardiography (ECG) (9,10,11). High quality defibrillation and cardioversion applied in a timely, proper manner improve the survival (7).

The aim of the present study was to investigate the knowledge level and skills of paramedics whose duties, authorities and responsibilities had been defined in 2004 and who are working for the 112 emergency service ambulances, on deciding upon and applying defibrillation and cardioversion, and thereby to make a contribution to the literature.

Material and Methods

The study universe was composed of 136 paramedics who were working at the 112 emergency medicine ambulances in the Konya province between January and March 2017 in this cross-sectional study. Exclusion criteria were added for the study. Employees who are associate degree graduated from the first and emergency aid program but works as emergency medical technicians are not included in the study. The individuals who would be included in the sample were determined with random sampling with the stratified sampling method and 62 paramedics were included in the study by targeting to reach at least one person from each unit.

The personal data form, cardioversion and defibrillation application-evaluation observation forms, which included a coding system, were used for the data collection. The observation results were evaluated by the researcher during application of the scenarios prepared by the researcher and recorded on the data collection forms.

Approval was obtained from the ethics committee and the institution where the study was conducted (70632468-050.01.04/17283). Paramedics who participated in the study were informed about the research in their unit. Informed consent was read to the paramedics and verbal consent was obtained. So, they participated in the study as volunteers. The fact that the researcher was an observer was explained to the participants prior to the study. The participants were informed about the interventions to be applied by the researcher before and during the study, but not about the assessment criteria and patient characteristics. For making it closer to reality, adult ambu branded model compatible with defibrillation and cardioversion, LeardalHeartSim CPR simulator and primedic monophasic defibrillator were used for the interventions (defibrillation, cardioversion, etc.) that could be harmful when applied directly on the patient in the study.

Statistical analyses were carried out using the SPSS 21.0 (Statistical Package for Social Sciences). While the descriptive statistics of the paramedics were given as frequency and percent, the Phi/Cramer's V coefficient was used for determination of the power of the associations detected in the analyses of the significant parameters according to the chi-square test. A p level of <0.05 was accepted as statistically significant.

Results

The demographic data, educational status and the experience level of the participants have been presented in Table 1.

According to the defibrillation application and assessment form, more than half of the participants were detected not to do pulse control concurrently with the rhythm (58.1%), not to make a decision for starting CPR before defibrillation (58.1%); they were found to be successful in the selection of a proper energy level (79.1%); however, they did not make energy selection when the defibrillator electrodes were on the device for a safe defibrillation (56.5%). The participants who did not make a decision for defibrillation (3.2%) and who did not take off the clothes of the patient (19.4%) were directed by the researcher for continuation of the scenario (Table 2).

Of the participants, more than 70% were found to recognize VT within the first 10 seconds (88.7%), control carotid artery pulse concurrently with the rhythm (88.5%), make a decision for cardioversion within the first 10 seconds (75.8%), take off the clothes of the patient and perform preparation for the cardioversion step (85.5%), make SYNC button active (72.6%), place defibrillator electrodes on the proper site (85.5%), apply pressure onto the defibrillator electrodes (71%), perform a successful discharge procedure (98.4%) and evaluate pulses following cardioversion (80.6%). The participants who did not make a decision for cardioversion (11%) and who did not prepare the patient for cardioversion

Variables	Number (n)	Percentage (%)
Gender		
Female	36	58.1
Male	26	41.9
Age		
21-25 years	23	37.1
26-30 years	23	37.1
31 years and above	16	25.8
Education status		
Associate degree	52	83.9
Graduate and post-graduate degree	10	16.1
Marital status		
Married	31	50.0
Single	31	50.0
Profession seniority		
0-5 years	27	43.5
6-10 years	27	43.5
10 years and above	8	13.0
The unit where he/she works		
Center	30	48.4
County	32	51.6
Status of attending adult life support training		
No	3	4.8
In 2014 and before	35	56.5
In 2015 or after	24	38.7
Status of attending adult simulation training		
No	41	66.1
Yes	21	33.9
Total	62	100.0

Table 1. Distribution of socio-demographic variables, education and experience

Variables	Number (n)	Percentage (%)
Recognizing VF rhythm		
No	6	9.7
Yes (within 10 seconds)	56	90.3
Concurrent pulse and rhythm control with		
No	36	58.1
Yes- Others	1	1.6
Yes- Carotid Artery	25	40.3
Making a decision for CPR until defibrillator device is ready		
No	26	58.1
Yes	36	41.9
Making a decision for defibrillation		
No	2	3.2
Yes- (20 seconds and above)	2	3.2
Yes- (11-20 seconds)	2	3.2
Yes- (Within 0-10 seconds)	56	90.4
Taking the clothes off at defibrillation application area		
No	12	19.4
Yes	50	80.6
Applying gel onto defibrillation application area		
No	11	17.7
Yes- Incorrect	11	17.7
Yes- Correct	40	64.6
Selecting energy when defibrillator electrodes are on the device		
No- Incorrect joule	12	19.3
No- Correct joule	35	56.5
Yes- Incorrect joule	1	1.6
Yes- Correct joule	14	22.6
Placement of defibrillator electrodes		
Incorrect	12	19.4
Correct	50	80.6
Energy loading on defibrillator electrodes		
Other	31	50
On the patient	31	50
Applying pressure on defibrillator electrodes		
No	23	37.1
Yes	39	62.9
Safety/ Warning		
No	26	41.9
Yes	36	58.1
Successful discharge procedure		
Yes	62	100
Making a decision for CPR 2 minutes following defibrillation		
No	5	8.1
Yes	57	91.9

Table 2. Statistical analysis of making a decision for and applying defibrillation

by taking off the clothes (14.5%) were directed by the researcher for continuation of the scenario (Table 3).

Energy selection when the defibrillator electrodes are on the defibrillator for defibrillation differs from the energy selection when the defibrillator electrodes are on the defibrillator for cardioversion (X^2=36.342; p=0.000<0.05). The categorical association values were determined to be Phi=0.766; Cramer's V=0.766; Contingency Coefficient=0.608 and a high directly proportional association was determined (Table 4).

Enabling safety for defibrillation/warning differs from enabling safety for cardioversion/warning (X^2=22.940; p=0.000<0.05). The categorical association values were found to be Phi=0.608; Cramer's V=0.608; Contingency Coefficient=0.520 and a more than moderate directly proportional association was determined (Table 5).

Discussion

The gradual increase in cardio-vascular diseases-related mortality and morbidity, VF being the first observed rhythm at the time of arrest and defibrillation being the most effective treatment for VF reveal the importance of recognizing the rhythm (12). In a study evaluating the paramedic students who receive advanced cardiac life support (ACLS) training, more than half of them were seen to fail in the questions about rhythm (13). In another study investigating the attitudes and behaviors of paramedics and emergency medicine technicians on ECG, the vast majority of the students answered the questions about ECG rhythms,

Variables	Number (n)	Percentage (%)
Recognizing VT rhythm		
No	5	8.1
Yes (10 seconds above)	2	3.2
Yes (within 10 seconds)	55	88.7
Concurrent pulse and rhythm control with		
No	8	12.9
Yes- Others	1	1.6
Yes- Carotid Artery	53	85.5
Inquiring stability/ instability finding		
No	26	58.1
Yes	36	41.9
Making a decision for cardioversion		
No	7	11.3
Yes- (11-15 seconds)	8	12.9
Yes- (Within 0-10 seconds)	47	75.8
Taking the clothes off at cardioversion application area		
No	9	14.5
Yes	53	85.5
Applying gel onto cardioversion application area		
No	31	50
Yes- Incorrect	5	8.1
Yes- Correct	26	41.9
Activation of SYNC button		
No	17	27.4
Yes	45	72.6
Selecting energy when defibrillator electrodes are on the device		
No- Incorrect joule	17	27.4
No- Correct joule	32	51.6
Yes- Incorrect joule	3	4.8
Yes- Correct joule	10	16.1
Placement of defibrillator electrodes		
Incorrect	9	14.5
Correct	53	85.5
Energy loading on defibrillator electrodes		
Other	20	32.3
On the patient	42	67.7
Applying pressure on defibrillator electrodes		
No	18	29
Yes	44	71
Safety/ Warning		
No	38	61.3
Yes	24	38.7
Successful discharge procedure		
No	1	1.6
Yes	61	98.4
Assessment of carotid artery pulse following cardioversion		
No	12	19.4
Yes	50	80.6

Table 3. Statistical analysis of making a decision for and applying cardioversion

mainly fatal rhythms including VF, correctly (14). In a study evaluating the knowledge level of the nurses working in emergency and intensive care units on ECG, the rate of recognizing VF increased following education (15). In a study investigating the knowledge level about resuscitation instructions in basic and advanced life support, 75.4% of the physicians and 54.9% of the nurses were seen to recognize the rhythms treatable with shock (16).

In our study, the rate of recognizing emergency rhythms was quite high; however, the rate of controlling carotid artery

		Cardioversion							
		1	2	3	4	Total	X^2	p	Phi/ cramer's
Defibrillation	1	25(3)	66.7(8)	0(0)	1.9(1)	12	36.342	0.000	0.766
	2	34.3(12)	62.9(22)	0(0)	2.9(1)	35			
	3	0(0)	0(0)	0(0)	100(1)	1			
	4	14.3(2)	14.3(2)	21.4(3)	50(7)	14			
	Total	27.4(17)	51.6(32)	4.8(3)	16.1(10)	62			

*(1) The defibrillator electrodes are not on the defibrillator- Incorrect joule
*(2) The defibrillator electrodes are not on the defibrillator- Correct joule
*(3) The defibrillator electrodes are on the defibrillator- Incorrect joule
*(4) The defibrillator electrodes are on the defibrillator- Correct joule

Table 4. The association between energy selection and defibrillation-cardioversion

pulse concurrently was low due to having been focused on rhythm only and treatment after the patient lost consciousness. In a study evaluating the knowledge level and skills of the health professionals about basic life support and defibrillation, the participants were found to be successful at controlling carotid artery pulse and/or vital signs; however, the study did not evaluate the concurrent control of pulse and rhythm (17). In a study, 61% of the participants answered the question "What would your first intervention be in a patient who becomes unconscious and whose pulse cannot be palpated when being followed-up at the hospital?" as "I start cardiac massage." (18). In our study, more than half of the participants did not make a decision for starting CPR before defibrillation. It is suggested that the participants skipped this step as they were alone when VF was diagnosed and started defibrillation, and they should state cardiac massage verbally, and thereby it is recommended to perform a similar study with a team of 3 members.

		Cardioversion					
		No	Yes	Total	X^2	p	Phi/ cramer's v
Defibrillation	No	96.2(25)	3.8(1)	26	22.94	0.000	0.608
	Yes	36.1(13)	63.9(23)	36			
	Total	61.3(38)	38.7(24)	62			

Table 5. The association between enabling safety/warning and defibrillation/cardioversion

Thirty minutes of delay in starting advanced cardiac life support (ACLS) or this duration exceeding 90 minutes together with transport time does not accord with life. Therefore, defibrillation is not only defined as a useful intervention, but it also adds 29 minutes of delay for reaching the hospital (19). In a study including 134 physicians working at different clinics and evaluating the resuscitation knowledge level in accordance with current guidelines, 67.2% of the participants were determined to apply defibrillation at the correct rhythm (20). In our study, almost all paramedics made a decision for defibrillation within the

first 10 seconds. Applying near-real scenarios on the model during in-service trainings is suggested to positively influence success.

Placing the electrodes on the body without applying gel leads to severe irritation and burns during defibrillation and cardioversion procedures (1). In our study, 17.7% of the participants were determined not to apply the gel on the application site and 17.7% were found to apply the gel on the defibrillator electrodes (incorrect). In a study, this step was found to be frequently skipped (18). It is suggested that the importance of gel use should be emphasized during in-service training for health professionals and patient safety. In our study, the paramedics were found to be successful in the selection of a proper energy level; however, more than half were determined to select energy after handling the defibrillator electrodes. In a study evaluating the outcomes of basic life support and defibrillation course at a university hospital, 96.2% of the participants were seen to select the proper energy for defibrillation and in another study, 50% of the physicians and 43.9% of the nurses were seen to be successful for energy selection (16,17). In our study, 37.1% of the paramedics were determined not to apply pressure on defibrillator electrodes during defibrillation. It is suggested that the numbers may not reflect the accurate result as the participants stated after the assessment that they had applied pressure; the study was observational, and an accurate depth measurement could not be made visually. In one study, the most important shortage in defibrillation applications was the models not being proper for defibrillation and thereby shock could not be applied through applying pressure onto the chest with defibrillator electrodes (17).

It was predicted that the insufficiency could be in the safety/warning step as the study was conducted in a safe field for the participants. Almost half of the paramedics were found not to give warning before defibrillation, supporting our prediction. All participants performed a successful discharge procedure on the model. In one study, 80.2% of the participants warned before discharge and 93.4% applied shock. However, the defibrillator spoons were placed over the patient during shock and therefore, a comparison could not be made with our study (17). In order to be able to observe the outcomes accurately and clearly, it is recommended to conduct a similar study in a crowded environment that requires safety measures (a safe area prepared by the researchers).

In our study, almost all participants were determined to recognize VT and control the pulse concurrently and to make a decision for cardioversion. Stability/instability findings should be questioned before cardioversion (4,21). In our study, more than half of the participants stated that the patient's being unconscious was sufficient for making a decision of instability and did not question the other findings. The participants were found to be successful in the step of preparing the patient for cardioversion through taking off the clothes of the patient; however, half of them were determined not to apply gel on the application site. It is suggested to put emphasis on this issue in safe cardioversion steps. The SYNC button should be activated before each cardioversion. Of the participants, 72% were found to activate the SYNC button in our study.

In our study, more than half of the participants were found to select the proper energy for cardioversion; however, they were found to be insufficient in the step of selecting the proper energy when the defibrillator electrodes were on the defibrillator for cardioversion. More than half of the participants were seen to perform energy loading when the defibrillator electrodes were on the patient, and to apply pressure to the defibrillator electrodes for the cardioversion procedure; however, they were found to be insufficient in the stimulus applying step. Almost all participants were determined to place the defibrillator electrodes at the proper site, and to perform a successful discharge and pulse assessment following cardioversion.

Energy selection when the spoons were on the defibrillator was more successful in the defibrillation procedure compared to cardioversion; however, the most similar behaviour was joule use. There were differences between defibrillation and the cardioversion procedures with regard to providing safety/warning and the most similar behaviors were observed in not ensuring safety. More attention should be paid at this step, particularly during the cardioversion procedure.

Limitations

The present study is the first which observationally evaluates defibrillation and cardioversion procedures through near-real scenarios and the data were limited to paramedics who worked in the Konya province.

Conclusion

It was concluded that paramedics are successful in recognizing rhythm, making a decision for defibrillation and cardioversion, and that simulation training improved the skills. On the other hand, the participants were seen to have insufficiencies at concurrent pulse and rhythm control, making a decision for starting CPR, energy selection when the defibrillator electrodes were on the defibrillator and energy load when the defibrillator electrodes were on the patient, inquiring stability/instability findings, applying gel and enabling safety/warning during the cardioversion procedure.

A certain loss in recalling the skills and in practice performance is inevitable due to time. Therefore, it may be recommended to generalize simulation trainings, making

evaluations, not only for theoretical knowledge, but also for skills, and paramedics to follow updated guidelines.

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