Chron Precis Med Res 2024; 5(1): 1-6
DOI: 10.5281/zenodo.10885992

ORIGINAL ARTICLE
ORİJİNAL ARAŞTIRMA

Knowledge and Opinions of Consultant and Resident Anesthesiologists on the Features and Use of Defibrillators and Automatic External Defibrillators: A Cross-Sectional Survey Study in Türkiye

Anesteziyoloji ve Reanimasyon Uzman ve Uzmanlık Öğrencilerinin (Asistanlarının) Manuel ve Otomatik Eksternal Defibrilatörler Hakkındaki Bilgi ve Görüşleri ile Deneyimleri: Kesitsel Bir Araştırma

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ABSTRACT

Aim: When there is a rhythm like ventricular fibrillation or pulseless ventricular tachycardia, prompt and effective defibrillation is the critical intervention in cardiac arrest. Therefore, knowing what to do and being familiar with the instruments used for this purpose is vital. The present study aimed to investigate the possibility of insufficient knowledge and opinions of consultant and resident anesthesiologists about defibrillators and to put forward constructive proposals for reforming, if necessary.

Material and Method: This cross-sectional survey study included consultant and resident anesthesiologists. We sent questionnaires to 467 anesthesiologists via e-mail. The questionnaire included demographics, working status, duration, residency institution, workplace, experience with the defibrillator and automated external defibrillator (AED), previous cardiopulmonary resuscitation (CPR) training, and technical knowledge of defibrillators &AEDs.

Results: Three hundred and forty (72.8%) anesthesiologists filled out the questionnaires. Their mean age was 38.3±8.3 years. Twenty-five percent of them were residents. Of the anesthesiologists, 325(95.6%) used a defibrillator, 129(37.9%) witnessed out-hospital cardiac arrest, 69(20.3%) used AEDs, and 216(63.5%) attended CPR courses. There are significant differences in opinions and knowledge of anesthesiologists about defibrillator/defibrillation when compared to working duration, workplace, being a consultant, and having a previous CPR course.

Conclusion: Experience and information about defibrillators among anesthesiologists seem to be lacking. Continuous retraining through the guidelines can be considered as a possible updating method.

Keywords: Cardiac arrest, ventricular fibrillation, pulseless ventricular tachycardia, defibrillation, automatic external defibrillation

ÖZ

Amaç: Kardiyak aresttе ventriküler fibrilasyon veya nabızsız ventriküler taşıkardi gibi bir ritim olduğunda hızlı ve etkili defibrilasyon kalp durmasında kritik bir müdahaledir. Bu nedenle nasıl defibrilasyon ayapılacağını bilmek ve bu amaç için kullanılan ekipmanlara aşina olmak hayati öneme sahiptir. Bu çalışmada, olasılığını araştırmayı amaçladı. Anesteziyoloji ve reanimasyon uzman ve asistanların bilgi ve görüşlerinin yetersiz olması olasılığını ve gerekirse yapıcı öneriler geliştirmeyi amaçladık.

Gereç ve Yöntem: Bu kesitsel araştırmada, ülkemizdeki 467 anesteziyoloji ve reanimasyon uzman ve asistanlarına e-posta ile çalışma anketi ulaştırıldı. Ankette demografik bilgiler, mesleki süre, çalıştıkları kurum, önceki kardiyopulmoner resüsitasyon (KPR) eğitimi ile manuel defibrilatör ve otomatik eksternal defibrilatör (OED) hakkında teknik bilgiler ve deneyimler soruldu.

Bulgular: Üç yüz kırk (%72,8) anestezist ankete katıldı. Katılımcıların ortalama yaşları 38,3±8,3 yıl idi. Bunların yüzde yirmi beşi asistan idi. Anestezi uzmanlarından,325'i (%95,6) defibrilatör kullanmış, 129'u (%37,9) hastane dışı kardiyak areste tanık olmuş, 69'u (%20,3) OED kullanmış ve 216'sı (%63,5) KPR kurslarına katılmış idi. Çalışma süreleri ve yerleri, uzman olmaları, KPR kursu almış olmaları karşılaştırıldığında anestezi hekimlerinin defibrilatör/defibrilasyon konusundaki görüş ve bilgilerinde ciddi farklar vardır.

Sonuç: Defibrilatörlerle ilgili deneyim ve bilgiler anestezistler arasında eksik gibi görünmektedir. Kılavuzlar aracılığıyla sürekli ve yeniden eğitimlerin verilmesi olası bir güncelleme yöntemi olarak düşünülebilir.

Anahtar Kelimeler: Kardiyak arest, ventriküler fibrilasyon, nabızsız ventriküler taşikardi, defibrilasyon, otomatik eksternal defibrilasyon

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Başvuru Tarihi/Received: 04.11.2023
Kabul Tarihi/Accepted: 23.02.2024

INTRODUCTION

Sudden cardiac arrest is a significant health problem. A substantial percentage of sudden cardiac arrest is witnessed in out-of-hospital settings (1, 2). Survival rates are low in both in-hospital cardiac arrest (IHCA) and out-of-hospital cardiac arrest (OHCA) because survival depends on high-quality cardiopulmonary resuscitation (CPR) (3, 4). The International Consensuses on CPR have emphasized the importance of immediate recognition, early CPR, and early defibrillation as critical elements in survival (5, 6). When there is a rhythm such as ventricular fibrillation or pulseless ventricular tachycardia, prompt and effective defibrillation becomes the essential intervention, especially in adult patients (7).

Defibrillators having different features are available, including automated external defibrillators (AEDs) in public locations for citizen use (8). According to evidence-based data, it is recommended to prefer defibrillators having biphasic shock waveforms and adhesive pads instead of paddles, if possible (9). Innovative programs, coordinated organizational infrastructure, and emergency medical systems are carefully planned (10, 11). As a result, there is a piece of evidence for improvement in survival rates after OHCA, especially if it is due to the life-threatening rhythm (6). AEDs are also considered in hospital settings, especially in areas where staffs have no rhythm recognition skills or defibrillators are used infrequently to decrease collapse to first shock time (12).

The current literature suggests the importance of non-technical skills in high-quality CPR; however, retraining healthcare personnel still does not maintain its significance (13). The 2015 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations has underlined that retraining cycles of 1 to 2 years are inadequate to maintain competence in resuscitation skills (6).

AED use is not very common in Turkiye yet; however, training about AED use has found its place in CPR courses. Legislation and legal infrastructure work for the use and maintenance of AEDs in our country are about to be completed with the efforts of the Turkish Society of Anesthesiology and Reanimation administrators. Anesthesiologists are crucial in training healthcare workers and developing quality standards regarding in-hospital CPR.

In our country, data is still lacking about the knowledge and experience of an anesthesiologist in defibrillators and AED. For this reason, we aimed to investigate the opinions and expertise of consultants and resident anesthesiologists about defibrillator devices in Turkiye to support the existing data and, if possible, to provide availability for strategy planning in training.

METHODS

This study was approved by Dr. Abdurrahman Yurtarslan Training and Resarch Hospital Clinical Research Ethics Committee (Date: 11.06.2015, Decision no: 2015-07/172). We conducted this cross-sectional survey study between 15.9.2015 and 15.03.2016 between consultant and resident anesthesiologists.

After the current literature search, we developed the survey content by consensus and included 23 open-ended and categorical questions. The first part of the questionnaire had demographic characteristics, including age, gender, working statuses of the anesthesiologists as consultants or residents, duration of work, residency institution, and workplace. The second part of the questionnaire included questions about an experience with defibrillator and AED use, previous CPR training, and technical knowledge of defibrillators and AEDs.

We sent questionnaires to 467 anesthesiologists who registered with the Turkish Society of Anesthesiology and Reanimation via e-mail. A reminder e-mail was sent to all anesthesiologists one week after the first e-mailing. Anesthesiologists who filled out the questionnaire were included in the analysis.

Statistical Analysis

Analyses were performed using the Statistical Package for the Social Sciences version 17.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were expressed as mean± standard deviation or median (minimum-maximum) for numerical cut-off variables, while categorical variables were expressed as some participants and percentages. Fisher's exact test was used in cases where the expected frequency was less than 5 in 2×2 cross tables. When the predicted frequency was in the range of 5-25, the Continuity Corrected Chi-Square test was used; and when the expected frequencies were over 25, Pearson's Chi-Square test was used. The likelihood ratio test was used when the standard frequency was less than 5 in at least two eyes in the R×C crosstabs. Otherwise, Pearson's Chi-square test was used. The results were considered statistically significant in the case of $p < 0.05$.

RESULTS

Among 467 anesthesiologists to whom the questionnaires were sent, 340 (72.8%) filled out the questionnaires, and 215 (63.2%) were female. The mean age of the anesthesiologists was 38.3± 8.3 years (range, 25-63 years). Of the anesthesiologists, 25.0% were residents. Demographic characteristics of the anesthesiologists are presented in **Table 1**.

Table 1. Demographic characteristics of the anesthesiologists included in the study

Characteristics	N=340
Age, year, mean± SD (range)	38.3±8.3 (25-63)
Gender, n (%)	
Female	215 (63.2)
Male	125 (36.8)
Resident anesthesiologists, n (%)	85 (25.0)
Working duration, n (%)	
1 year	24 (28.2)
2 years	20 (23.5)
3 years	13 (15.3)
4 years	20 (23.5)
5 years	8 (9.4)
Institution where the training was received, n (%)	
University Hospital	52 (61.2)
Education and Research Hospital	33 (38.8)
Consultant anesthesiologists, n (%)	255 (75.0)
Institution where the training was received, n (%)	
University Hospital	154 (60.4)
Training and Research Hospital	101 (39.6)
Working duration, n (%)	
0-5 years	68 (26.7%)
6-10 years	78 (30.6%)
>10 years	109 (42.7%)
Working place, n (%)	
University Hospital	75 (29.4)
Training and Research Hospital	102 (40.0)
State Hospital	39 (15.3)
Private Hospital	39 (15.3)
Academic position	
Specialist	172 (67.5)
Assistant professor	26 (10.2)
Associated professor	40 (15.7)
Professor	17 (6.7)

SD, standard deviation

Details about previous training about CPR, defibrillator and AED usages are presented in **Table 2**. The result reveals that training for CPR and practical usage of AED is at critically low levels. For residents, these parameters can be accepted as suitable levels. parameters can be accepted as suitable level.

Table 2. Distribution of the anesthesiologists regarding previous cardiopulmonary resuscitation training/course, and defibrillator and automatic external defibrillator use experiences

	Consultant anesthesiologists (n=255) n (%)	Resident anesthesiologists (n=85) n (%)	Total (n=340) n (%)
Having CPR training/course			
Yes	187 (73.3)	29 (34.1)	216 (63.5)
Defibrillator use	251 (98.4)	74 (87.1)	325 (95.6)
Have you ever encountered an OHCA?/Yes	113 (44.3)	16 (18.8)	129 (37.9)
Have you ever seen AED?/Yes	175 (68.6)	40 (47.1)	215 (63.2)
Have you ever used AED?/Yes	65 (25.5)	4 (4.7)	69 (20.3)

CPR, cardiopulmonary resuscitation; OHCA, out-of-hospital cardiac arrest; AED, automatic external defibrillator

The distribution of the anesthesiologists regarding the knowledge about features of defibrillators and AEDs are presented in **Table 3**. In this table, we revealed that biphasic shockwave form, manual mode, paddle type of AED, presence of cardioversion, and OHCA conditions were significantly known by consultants.

Table 3. Distribution of the anesthesiologists in terms of their opinions and knowledge about the use and features of defibrillators and automatic external defibrillators

	Consultant anesthesiologists (n=255) n (%)	Resident anesthesiologists (n=85) n (%)	p value
Defibrillators			
Placement of paddles			
Standard	226 (90.0)	66 (89.2)	>0.999†
Anteroposterior	28 (11.2)	7 (9.5)	0.841†
Bi-axillary	17 (6.8)	1 (1.4)	0.086‡
Shockwave form			
Monophasic	67 (26.3)	30 (35.3)	0.145†
Biphasic	214 (83.9)	62 (72.9)	0.037†
Not known	18 (7.1)	13 (15.3)	0.039†
Mode			
Manual	158 (62.0)	36 (42.4)	0.002¶
Automatic	84 (32.9)	30 (35.3)	0.691¶
Not know	47 (18.4)	27 (31.8)	0.015†
Types of paddles			
Paddle	205 (80.4)	58 (68.2)	0.030†
Adhesive pads	55 (21.6)	17 (20.0)	0.878†
Not know	32 (12.5)	22 (25.9)	0.006†
Pediatric paddles			
Absent	42 (16.5)	16 (18.8)	0.739†
Present	134 (52.5)	36 (42.4)	0.103¶
Not know	79 (31.0)	33 (38.8)	0.183¶
PACE			
Absent	57 (22.4)	20 (23.5)	0.940†
Present	108 (42.4)	30 (35.3)	0.251¶
Not know	90 (35.3)	35 (41.2)	0.330¶
Cardioversion			
Absent	5 (2.0)	7 (8.2)	0.013‡
Present	216 (84.7)	60 (70.6)	0.006†
Not know	34 (13.3)	18 (21.2)	0.117†
AEDs			
Conditions in which AEDs are used			
OHCA	239 (93.7)	69 (81.2)	<0.001†
IHCA	114 (44.7)	29 (34.1)	0.087‡

OHCA, out-of-hospital cardiac arrest; IHCA, in-hospital cardiac arrest AED, automatic external defibrillator, † Continuity corrected Chi-square test, ‡ Fisher's exact test, ¶ Pearson's Chi-square test.

Also, consultants defined best the needs of airport AEDs in **Table 4**. Finally, consultants pointed out nurses, anesthesia technicians, and paramedics can use AED in **Table 4**.

Anesthesiologists' distribution of their opinions and knowledge about the use and features of defibrillators and AEDs for having or not having a CPR course is presented in **Table 5**. In this table, opinions and experiences of the "Having a CPR course before" consultants and residents are most significant in specific parameters, as shown in the table.

Table 4. Distribution of the consultant anesthesiologists according to their working places in terms of their opinions and knowledge about the placement of defibrillators and automatic external defibrillators

	Working places				p value
	University Hospital (n=75) n (%)	Research and Training Hospital (n=102) n (%)	State Hospital (n=39) n (%)	Private Hospital (n=39) n (%)	
AEDs should be placed in					
Airport	75 (100.0)[d,b]	95 (93.1)[a]	37 (94.9)	36 (92.3)[a]	0.032†
Plane	64 (85.3)	83 (81.4)	30 (76.9)	33 (84.6)	0.693‡
Restaurant	43 (57.3)	45 (44.1)	20 (51.3)	16 (41.0)	0.249‡
School	62 (82.7)[d,b]	65 (63.7)[a]	27 (69.2)	25 (64.1)[a]	0.040‡
Apartment	28 (37.3)[d,b]	14 (13.7)[a]	9 (23.1)	5 (12.8)[a]	<0.001‡
Hospital	51 (68.0)	57 (55.9)	19 (48.7)	20 (51.3)	0.148‡
Metro station	72 (96.0)[b,c,d]	84 (82.4)[a]	30 (76.9)[a]	31 (79.5)[a]	0.014‡

OHCA, out-of-hospital cardiac arrest; IHCA, in-hospital cardiac arrest AED, automatic external defibrillator, † probability test, ‡ Pearson's chi-square test, a significantly different from university hospital at p<0.05, b significantly different from training and research hospital at p<0.05, c significantly different from state hospital at p<0.05, d significantly different from private hospital at p<0.05

Table 5. Distribution of the anesthesiologists with respect to having or not having a CPR course before in terms of their opinions and knowledge about the use and features of defibrillators and automatic external defibrillators.

	Having a CPR course before (n=216) n (%)	Not Having a CPR course before (n=124) n (%)	p value
Defibrillators			
Placement of paddles			
Standard	194 (91.1)	98 (87.5)	0.411†
Anteroposterior	25 (11.7)	10 (8.9)	0.557†
Bi-axillary	17 (8.0)	1 (0.9)	0.016†
Shockwave form			
Monophasic	60 (27.8)	37 (29.8)	0.685‡
Biphasic	191 (88.4)	85 (68.5)	<0.001†
Not known	12 (5.6)	19 (15.3)	0.005†
Mode			
Manual	136 (63.0)	58 (46.8)	0.004‡
Automatic	79 (36.6)	35 (28.2)	0.117‡
Not known	36 (16.7)	38 (30.6)	0.003‡
Types of paddles			
Paddle	180 (83.3)	83 (66.9)	<0.001‡
Adhesive pads	50 (23.1)	22 (17.7)	0.240‡
Not known	22 (10.2)	32 (25.8)	<0.001†
Pediatric paddles			
Absent	35 (16.2)	23 (18.5)	0.687†
Present	116 (53.7)	54 (43.5)	0.071‡
Not known	65 (30.1)	47 (37.9)	0.140‡
PACE			
Absent	41 (19.0)	36 (29.0)	0.033‡
Present	105 (48.6)	33 (26.6)	<0.001‡
Not known	70 (32.4)	55 (44.4)	0.028‡
Cardioversion			
Absent	4 (1.9)	8 (6.5)	0.034¶
Present	191 (88.4)	85 (68.5)	<0.001†
Not known	21 (9.7)	31 (25.0)	<0.001†
AEDs			
Conditions in which AEDs are used			
OHCA	201 (93.1)	107 (86.3)	0.062†
IHCA	98 (45.4)	45 (36.3)	0.103‡
Only in adults	12 (5.6)	8 (6.5)	0.921†
Not known	7 (3.2)	14 (11.3)	0.006†
Processes performed by AEDs			
Rhythm analysis	180 (83.3)	84 (67.7)	<0.001‡
Defibrillation	199 (92.1)	101 (81.5)	0.006‡
Chest compression	16 (7.4)	9 (7.3)	>0.999†
Cardioversion	101 (46.8)	63 (50.8)	0.472‡
Not known	5 (2.3)	15 (12.1)	<0.001†

OHCA, out-of-hospital cardiac arrest; IHCA, in-hospital cardiac arrest AED, automatic external defibrillator, † Continuity corrected Chi-square test, ‡ Fisher's exact result Chi-square test, ¶ Pearson's Chi-square test.

DISCUSSION

A physician may witness IHCA or OHCA and be expected to intervene; defibrillation training is essential in medical training. Consultants of anesthesiology and reanimation have a leading role in training healthcare workers about developing and implementing defibrillation standards in hospital settings. The present study's results showed some knowledge gaps about the technical features of defibrillators and AEDs and different opinions on their use.

It was surprising that a critical rate of the consultants stated that they did not know about the mode, paddle or adhesive pad, existence of pediatric paddles, and PACE and cardioversion features of defibrillators. The residents are expected to have less knowledge than the consultants due to less experience and uncompleted training. Studies about CPR conducted with physicians working in different specialties have revealed a difference in understanding of defibrillation and AED, and all of them have underlined the importance of retraining (14-16). The results of the present study showed that prior training differed the expertise and opinions of anesthesiologists about defibrillators and AED features and use. In guidelines, it has also been underlined the importance of retraining healthcare workers to prevent the degradation of CPR skills (6).

Variation among anesthesiologists may partly be related to the lack of standardization of resuscitation care and the CPR committee's existence to improve CPR quality in hospitals. In the US, a nationally representative survey showed that defibrillation standardization is high (88%), but debriefing is low (17). Therefore, institutions increased simulation training to strengthen the quality of CPR in hospitals (17). However, our study did not directly measure the impact of organizational factors or defibrillation standardization in hospitals. On the other hand, organizational factors might have affected the retraining cycle. In another study, higher knowledge and competence of anesthesiologists working in teaching hospitals resulted from more references of critical patients to tertiary care hospitals (16). Consultants

working in teaching hospitals or academic members actively participate in training students and residents, which may affect their knowledge about defibrillation.

The present results might also be related to national practical differences. In our study, the trademarks of the devices were not questioned; therefore, we did not know the technical features of the devices used by anesthesiologists. Our study found adhesive pads to be less used and known, whereas defibrillators are mainly known and used in biphasic shock wave mode. The rare usage and knowledge might have been due to the unavailability of adhesive pads. In a survey conducted among European countries, including Turkiye, there were differences regarding the implementation of resuscitation guidelines. In this guideline, the authors concluded that "there were still countries where adhesive pads were low due to economic and traditional reasons." However, guidelines recommended adhesive pads when bi-phasic defibrillators were used (6, 18).

The principal aim of promoting AED use was to increase survival and to decrease collapse to first shock time under 3 minutes in OHCAs (12, 19). However, AEDs have begun to be recommended in IHCA especially witnessed by staff with no rhythm recognition skills or in areas where defibrillators are not readily available (12). In the present study, a low rate of anesthesiologists agreed that AEDs could be used in IHCA, and the anesthesiologists did not know what AEDs could do except defibrillation. AED programs in hospitals are relatively new and not very common in Turkiye; therefore, the anesthesiologists who participated in the study might not be very experienced in using AEDs. It was shown that the knowledge of younger anesthesiologists about AEDs was better than the elder. Better understanding of young might explain why anesthesiologists who worked more than eleven years did less in some parameters regarding AEDs in our study.

AEDs with voice prompts can be used without training (16). In a recent study, it was found that AED-user-dependent time loss occurred in placing pads in IHCA. This loss could have been decreased if the "chain of advice" of AEDs interrupted first shock time was improved; thereby, the authors concluded that healthcare workers should be trained to use AEDs (20). On the other hand, opinions of the anesthesiologists about where AEDs should be placed and by whom AEDs should be used differed in the present study. Contrary to available literature and recommendations, only 58.2% of the anesthesiologists agreed that everyone could use AEDs.

Optimal public placement strategies have been based on population demographics, building time, mathematical optimization of initial cardiac arrest calls, and novel mathematical modeling approaches (10, 21). On the other hand, there was an evidence-based knowledge gap about optimal public AED deployment strategy (6). Thus, different opinions about AED placement can be expected, which is a more complex issue requiring the teamwork of other experts.

Limitations

The present study has some limitations. First, the ratio of participation in our study was low. Second, as our target population was the registered members of the Turkish Society of Anesthesiology and Reanimation, and as all anesthesiologists in Turkey do not register with this society, the survey results could not be generalized to all anesthesiologists in Turkiye. Third, there was a possibility of bias since those with more knowledge or experience were more likely to respond to the study questionnaire. However, we believe the present study might serve as a guide for developing and implementing training strategies for effective defibrillators.

CONCLUSION

There was a knowledge gap about the features of defibrillators among anesthesiologists. Previous CPR training and working as an academic member significantly differed in knowledge about parts of defibrillators and opinions of the participants about AED use. The residency training program should be re-evaluated regarding defibrillators. Continuous retraining cycles updated through the recommendations of current guidelines should be implemented about defibrillation as a part of CPR in hospitals, not for all healthcare workers but also consultants and residents of anesthesia and resuscitation.

ETHICAL DECLARATIONS

Ethics Committee Approval: This study was approved by Dr. Abdurrahman Yurtarslan Training and Resarch Hospital Clinical Research Ethics Committee (Date: 11.06.2015, Decision no: 2015-07/172).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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