EURASIAN JOURNAL OF EMERGENCY MEDICINE
DOI: 10.4274/eajem.galenos.2019.26818
Original Article
Eurasian J Emerg Med. 2019;18(3): 142-7

Knowledge and Skills of the Senior Students of Paramedical, Nursing and Medical Faculties on Cardiopulmonary Arrest Recognition, Maintenance of Chest Compression and Ventilation

Mehmet Murat Oktay[1], Semra Çelikli[1], Mustafa Boğan[2], Mustafa Sabak[3], Hasan Gümüşboğa[2], İbrahim Bilir[4], Şevki Hakan Eren[5]

[1]Programme of Emergency Medicine, Hasan Kalyoncu University Vocational High School, Gaziantep, Turkey
[2]Clinic of Emergency Medicine, Şehitkamil State Hospital, Gaziantep, Turkey
[3]Clinic of Emergency Medicine, Nizip State Hospital, Gaziantep, Turkey
[4]Department of Nursing, Hasan Kalyoncu University Faculty of Health Sciences, Gaziantep, Turkey
[5]Department of Emergency Medicine, Gaziantep University Faculty of Medicine, Gaziantep, Turkey

Abstract

Aim: We believe that automatic external defibrillators are not common in our country and aimed to compare the knowledge and skills of senior students in paramedical, nursing and medical faculties on recognizing cardiopulmonary arrest (CPA) case, providing proper chest compression and maintenance of ventilation as well as evaluating cardiopulmonary resuscitation (CPR) cycle one month before starting profession.

Materials and Methods: Fifty senior students from paramedic department, 50 senior students from nursing department and 50 senior students from medical school were included in the study. The participants were asked 10 theoretical questions to evaluate their basic resuscitation knowledge. Each participant was then asked to intervene in a suspicious CPA case using Prestan Adult CPR Manikin alone in a separate room.

Results: The highest rate of correct answers given to theoretical questions related to CPR was in paramedic students with a mean score of 7.34±1.99 points among the students of these three departments (p=0.001). The mean scores of both theoretical and practical application of paramedic students were found to be significantly higher than the students of the nursing and medical faculties, when all three groups were compared with each other with regard to their mean success scores of theoretical and practical applications.

Conclusion: In our study, the mean scores of both theoretical and practical application of paramedic students were found to be significantly higher than the other groups.

Keywords: Chest compress, medical students, cardiopulmonary arrest, cardiopulmonary resuscitation

Introduction

While cardiopulmonary arrest (CPA) describes the cease of breathing and circulatory functions, cardiopulmonary resuscitation (CPR) defines all of the practices that are carried out in order to ensure spontaneous breathing and circulation. Responding to CPA victims is an ethical and legal obligation for health professionals. However, some studies have been carried out to reveal the lack of knowledge and skills related to the CPR of health professionals (1,2). Effective chest compression is a critical intervention that affects post-CPA outcomes (3). It is indisputable that CPR practices that are properly carried out have positive effects on mortality and morbidity (4). Recognizing CPA, which is one of the application steps of Basic Life Support, and

Corresponding Author: Mustafa Boğan, Clinic of Emergency Medicine, Şehitkamil State Hospital, Gaziantep, Turkey
Phone: +90 506 940 44 25 **E-mail:** mustafabogan@hotmail.com **ORCID ID:** orcid.org/0000-0002-3238-1827

Cite this article as: Oktay MM, Çelikli S, Boğan M, Sabak M, Gümüşboğa H, Bilir İ, Eren ŞE. Knowledge and Skills of the Senior Students of Paramedical, Nursing and Medical Faculties on Cardiopulmonary Arrest Recognition, Maintenance of Chest Compression and Ventilation. Eurasian J Emerg Med. 2019;18(3):142-7.

Received: 10.01.2019
Accepted: 26.05.2019

rapid initiation of manual chest compression have become more important especially in out-of-hospital CPA cases in countries where automatic external defibrillator (AED) is not common.

We considered that AEDs are not common in our country and aimed to compare the knowledge and skills of senior students in paramedical, nursing and medical faculties on recognizing CPA, providing proper chest compression and maintenance of ventilation as well as evaluating CPR cycle one month before starting profession in our study. Our study is based on the practices of European Resuscitation Committee (ERC).

Materials and Methods

Ethics committee approval was obtained from Hasan Kalyoncu University and the study was conducted between 1-31 May in Paramedic Department of Vocational School of Hasan Kalyoncu University, Nursing Department of Vocational School of Hasan Kalyoncu University and Faculty of Medicine of Gaziantep University.

Fifty senior students from paramedic department, 50 senior students from nursing department and 50 senior students from faculty of medicine who volunteered and who were entitled to graduate after one month were included in the study. The participants were selected from the beginning of the list of schools and all participants did not receive simulation training before. Written consent was obtained from all participants. After the participants were informed about the study, 10 theoretical questions were asked to evaluate their basic resuscitation knowledge. Each participant was then asked to intervene in a suspicious CPA case using Prestan Adult CPR Manikin alone in a separate room. The applications carried out were recorded in accordance with the sequence of actions on forms that had been prepared before and where totally 10 intervention steps had been correctly and incorrectly ticked off. The evaluation of the accuracy and inaccuracy of application steps was based on the indicator system in the practice model. Each participant was given a total of five minutes for practical applications. Theoretical and practical applications were evaluated over a total of 10 points.

Response steps were as follows: 1) Recognizing CPA was grouped as steps number 1-5, 2) Correct form of maintenance of circulation and ventilation was grouped as steps number 6-8, 3) Evaluation of five cycles of CPR consisting of 30 compressions and two ventilations for two minutes through pulse check was grouped as steps number 9-10, and they were evaluated. After completing the practical applications, the participant was taken into a separate room and was able to talk to other practitioners during the application.

The exclusion criteria were as follows: participants studying in the middle grade classes of the mentioned university, participants who did not qualify to graduate one month after the start of the study, and participants who previously performed CPR application before the study.

Statistical Analysis

The normality of the data was tested statistically by Shapiro-Wilk test. Student's t-test was used to compare the data with normal distribution between two independent groups. Comparisons between multiple independent groups were conducted through ANOVA test. Multiple comparisons of the groups that were different in the ANOVA test were conducted through LSD test. Descriptive statistical methods were presented as number and percentage for categorical variables and as mean ± standard deviation for quantitative variables. SPSS for Windows version 13 was used for statistical analysis.

Results

The mean age of the students was 22.91±2.98 (range, 19-35) years. Of the participants, 55.3% (n=83) were female and 44.7% (n=67) were male. The mean score of the correct answers to theoretical questions was 6.29±2.3 (range, 0-10) and practical application was 5.63±2.82 (range, 0-10).

The highest rate of correct answers for theoretical questions related to CPR was in paramedic students with a mean score of 7.34±1.99 among the students of these three departments. Moreover, this group was the most successful group in application steps with a mean score of 6.54±2.14. The relationship between theoretical and practical application scores of paramedic students was consistent with each other and no statistically significant difference was found (p=0.056). The scores and statistical relationships between the success scores of theoretical and practical applications of students in nursing department and faculty of medicine are presented in Table 1. A statistically significant difference was found between the theoretical success scores of students in nursing department and faculty of medicine and their application scores ($p<0.05$). Accordingly, the rate of these scores was significantly higher than the rate of skills to practice theoretical information of both groups in them.

The mean scores of both theoretical and practical applications of paramedic students were found to be statistically and significantly higher than the students in nursing department and faculty of medicine when three groups were compared with each other with regard to their mean success scores of theoretical and practical applications (p=0.001) (Table 1).

Steps 1-5 were correctly performed by paramedic students at the highest level (p=0.001). The practitioners were expected

to perform two ventilations against 30 compressions for two minutes within the steps 6-8 where the circulation was expected to be correctly maintained. They were asked to position palms correctly, interlock the fingers of both hands, not to bend the arms from elbows, to get support from the shoulders, and to apply chest compression. Practitioners were expected to press the sternum 5-6 cm down and allow chest wall to raise again. Medical students were found to be more successful in this step (p=0.001). Paramedic students showed more significant application success than the other groups in the steps 9-10, including evaluation of CPR cycle through pulse check which was performed at the end of a cycle (p=0.001) (Table 2).

All groups correctly answered the questions "What should be the compression/ventilation ratio in an adult CPA case?" and "Which of the following is the infant group in Basic Life Support applications?". Both questions were answered correctly by 136 (90.7%) students. The most incorrectly answered question by all groups was "What should be the compression/ventilation ratio in a pediatric CPA case?" and it was answered incorrectly by 109 participants (72.7%) (Table 3).

The most accurately performed step by all groups (n=135, 90%) was "Step 6: 30 Chest Compression-2 Ventilation in Adult Case with CPR". The most inaccurately performed step by all participants was Step 8. It was expected from the participants to

Table 1. Relationship between theoretical knowledge and practical application

	n	Theoretical average	Application average	p
Paramedic students	50	7.34±1.9	6.54±2.1	(p=0.001)*
Nursing department	50	3.68±1.6	2.8±2	
Faculty of medicine	50	6.12±1.4	5.1±2.5	
Total	150	5.71±2.2	4.8±2.7	

*Significant at <0.05 level

Table 2. Application success

Application groups	Participant student groups	Mean	p
CPA recognition	Paramedic (n=50)	0.74±0.29	**(p=0.001)***
	Nursing (n=50)	0.30±0.27	
	Medicine (n=50)	0.56±0.28	
	Total (n=150)	0.53±0.33	
The correct form of maintenance of circulation	Paramedic (n=50)	0.49±0.28	**(p=0.001)***
	Nursing (n=50)	0.32±0.24	
	Medicine (n=50)	0.50±0.28	
	Total (n=150)	0.44±0.28	
Evaluation of cycle (every 2 minutes)	Paramedic (n=50)	0.68±0.42	**(p=0.001)***
	Nursing (n=50)	0.20±0.36	
	Medicine (n=50)	0.38±0.44	
	Total (n=150)	0.42±0.45	

*Significant at <0.05 level
CPA: Cardiopulmonary arrest

Table 3. Theoretical step evaluation

Theoretical question		Number (n)	Rate (%)
1. How many cm does the sternum collapse? during chest compression?	False	38	25.3
	True	112	74.7
2. During CPR, how many minutes is ventilation applied to the patient with CPA?	False	99	66.0
	True	51	34.0
3.What should be the ratio of compression/ventilation in case of an adult patient with CPA?	False	14	9.3
	True	136	90.7
4. How many rescue ventilations are applied to the pediatric patient in CPA case per minute?	False	69	46.0
	True	81	54.0
5. What should be the ratio of compression/ventilation in case of a pediatric patient with CPA?	False	109	72.7
	True	41	27.3
6. Which of the following is infant group in Basic Life Support applications?	False	14	9.3
	True	136	90.7
7. How many ventilations are applied to infant patients in CPA case per minute?	False	65	43.3
	True	85	56.7
8. How should be the chest compression in case of infant patient with CPA?	False	57	38.0
	True	93	62.0
9. What would you do if you did not observe ventilation and circulation at the end of the firs cycle?	False	84	56.0
	True	66	44.0
10. From which region is pulse checked in an adult and infant patient?	False	94	62.7
	True	56	37.3

CPA: Cardiopulmonary arrest

compress the sternum 5-6 cm down during chest compression; but 79.3% (n=119) of them performed the application in an incorrect way (Table 4).

Discussion

CPR knowledge is an important determinant in the success of resuscitation and plays a vital role in the absolute outcomes of acute and emergency cases (5). Standardization of CPR knowledge is a scientific obligatory for all institutions providing education of health sciences as well as a factor reducing mortality in CPA cases. The success rate related to the overall CPR knowledge of students in Faculty of Medicine, Nursing Department and Paramedical Department vary in the studies where they were both comparatively and individually evaluated in the literature (6-8). It can be stated that the level of theoretical knowledge of all groups is low when the evaluation is conducted by considering the pre-test results of these studies (1,7,9). In certain studies where CPR knowledge and skills of paramedics were compared with students of Faculty of Medicine and other health professionals, it was stated that they were more successful consistent with our study (6,10,11). Paramedic students were more successful in both theoretical questions and application steps, and there was a significant relationship between their theoretical and application scores in our study. We think that this is based on the fact that the basic subject of paramedic education is CPR and that paramedics especially focus on this subject.

There are studies in the literature reporting the fact that pediatric CPR knowledge is less than adult CPR knowledge and that health professionals are more diffident in this matter (12). There are studies revealing that knowledge and skills related to the pediatric CPR of both students in medical and health science areas and health professionals who work in pre-hospital areas and units of hospitals are insufficient (1,12,13). It has been indicated that only 19% of Pediatricians have theoretical and practical competence in a study (14). In our study, many of the participants were able to theoretically recognize CPA cases; however, they had not sufficient theoretical knowledge related to the compression/ventilation ratio. It can be postulated that this arises from the fact that CPR trainings are usually provided for the adult cases and on adult models, because adult CPA happens more frequently in daily practices.

Table 4. Application step evaluation

	Conclusion	Number (n)	Rate (%)
Step 1: The patient is held by her/his shoulder and shaken to evaluate the state of consciousness	True	60	40.0
	False	90	60.0
Step 2: Please loudly ask "How are you?"	True	62	41.3
	False	88	58.7
Step 3: If she/he does not answer. Please call for help	True	80	53.3
	False	70	46.7
Step 4: Please check the inner part of the mouth. Foreign body? Airway maneuver should be done	True	86	57.3
	False	64	42.7
Step 5: Please evaluate whether she/he breaths or not through "Look. Listen. Feel" method. Pulse check - Carotid Please do not spend more than 10 seconds for these steps	True	61	40.7
	False	89	59.3
Step 6: 30 Chest Compression-2 Ventilation in Adult with CPR	True	135	90.0
	False	15	10.0
Step 7: 100-120/min of compression palms are correctly placed. fingers of both hands are interlocked, arms are not bended by elbows and propped up from the shoulder and chest compression is applied	True	118	78.7
	False	32	21.3
Step 8: Sternum is sunken 5-6 cm down	True	119	79.3
	False	31	20.7
Step 9: Evaluation is carried out every 5 cycles	True	89	59.3
	False	61	40.7
Step 10: Pulse is checked from the Carotid Artery for 5 seconds. CPR is maintained, if there is no pulse (30 Chest compressions/2 ventilations) Breathing is checked, if there is pulse If there is no pulse. breathing is applied as 12 times / min. (one ventilation in every 5 sec.)	True	85	56.7
Airway maneuver is maintained, if there is pulse	False	65	43.3

Cardiopulmonary arrest recognition: Steps number 1-5, The Correct way of maintenance of circulation: Steps number 6-8, CPR cycle evaluation through pulse check: Steps number 9-10.

CPR: Cardiopulmonary resuscitation

In accordance with our study, ventilation/chest compression ratio in different age groups was correctly known at higher levels in a study conducted on students of nursing department (1). However, in a study comparing senior students of Faculty of Medicine and Dentistry, 27% of the participants in both groups incorrectly knew the 30/2-application rate of ventilation and chest compression in adults (5). There are several studies indicating that both students of health sciences and health professionals cannot successfully perform the application of compressing the sternum down to a sufficient depth in order for applying proper chest compression in the literature (10,15,16). Although 74.7% (n=112) of the participants correctly answered the theoretical question related to the depth where the sternum is compressed down during chest compression, 79.3% (n=119) of them failed in performing this application in our study. We think that this is due to a lack of in practical application.

CPR application begins with recognizing the patient with CPA. All health professionals are expected to quickly and properly recognize CPA case, unlike the rescuer from the public. There are studies indicating that all healthcare professional groups and students of health sciences have difficulty in recognizing CPA (2,15). Less than half of the participants correctly answered the questions related to recognizing arrest, but it was seen that paramedic students were more successful in steps of recognizing CPA than the other groups in our study.

For CPR applications where circulation is properly maintained, compression should be applied to the correct region manually, in correct number and at correct depth. It was indicated that as the number of chest compression increased, quality of compression decreased and sufficient depth of sternum collapse could not be achieved (17). It was seen that the participants usually applied the compression and ventilation ratio properly, but they could not sufficiently compress the sternum down in the studies conducted. This is not an important shortcoming for a proper CPR application in which circulation is maintained. Similarly, not placing the hand in the correct localization during chest

compression hinders an effective CPR application (5,10). In our study, the students of faculty of medicine were found to be more successful in maintaining circulation properly.

In our study, the participants were expected to evaluate CPA case by checking the pulse and without giving a break longer than 5 seconds for chest compression at the end of every cycle. This application step was successfully performed by the participants. In a study conducted with 52 hospital workers, the majority of the participants were able to evaluate CPR performance successfully with pulse control (18). Paramedic students were found to be superior to the other groups in the evaluation the cycle in our study.

Conclusion

Scientific CPR application should be known and performed by all health professionals, especially emergency doctors and emergency pre-hospital health care professionals. Therefore, current developments in scientific guidelines should be considered and the standardized educational curricula should be established in all educational institutions where the education on health sciences is provided. In our study, the mean scores of both theoretical and practical application of paramedic students were found to be significantly higher than the students in Nursing Department and Faculty of Medicine, when all of the three groups were compared with each other with regard to their mean success scores of theoretical and practical applications.

Ethics

Ethics Committee Approval: Hasan Kalyoncu University, approval number: 2018-05; date: 06.06.2018.

Informed Consent: Written consent was obtained from all participants.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: M.M.O., Concept: M.M.O., S.Ç., Design: M.M.O., Ş.H.E., Data Collection or Processing: S.Ç., İ.B., Analysis or Interpretation: M.B., H.G., Literature Search: M.M.O., S.Ç., M.S., Writing: M.M.O., M.B., Ş.H.E.

Conflict of Interest: No conflict of interest was declared by the authors.

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

References

1. Vural M, Koşar MF, Kerimoğlu O, Kızkapan F, Kahyaoğlu S, Tuğrul S, et al. Cardiopulmonary resuscitation knowledge among nursing students: a questionnaire study. Anatol J Cardiol. 2016;17:140-5.
2. Smereka J, Szarpak Ł, Czyzewski Ł, Zysko D, Smereka A. Are physicians able to recognition ineffective (agonal) breathing as element of cardiacarrest? The American Journal of Emergency Medicine. 2016;34:1165.
3. Jacobs I, Nadkarni V, Bahr J, Berg RA, Billi JE, Bossaert L, et al. Cardiac arrest and cardiopulmonary resuscitation outcome reports: update and simplification of the Utstein templates for resuscitation registries: a statement for healthcare professionals from a task force of the International Liaison Committee on Resuscitation (American Heart Association, European Resuscitation Council, Australian Resuscitation Council, New Zealand Resuscitation Council, Heart and Stroke Foundation of Canada, InterAmerican Heart Foundation, Resuscitation Councils of Southern Africa). Circulation. 2004;21:3385-97.
4. Field JM, Hazinski MF, Sayre MR, Chameides L, Schexnayder SM, Hemphill R, et al. Part 1: executive summary: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation. 2010;(18 Suppl 3):S640-56.
5. Sharma R, Attar NR. Adultbasic life support (BLS) awareness and knowledge among medical and dental interns completing internship from deemed university. NUJHS. 2012;2;6-13.
6. Kandiş H. Development of Knowledge and Skills in Cardiopulmonary Resuscitation for Medical Students and Research Assistants. Konuralp Tıp Dergisi. 2014;3:8-11.
7. Tuna A, Çelebi İ, Silahçılar A, Sezgin H, Şıpkın S, Karatutlu C, et al. Cardiopulmonary Resuscitation Education and Knowledge and Skill Levels of Students in Health School: Results of Six Months. Journal of the Human and Social Sciences Researches. 2017;6:1842-8.
8. Goodwin T, Delasobera BE, Strehlow M, Camacho J, Koskovich M, D'Souza P, et al. Indianand United States paramedic students: comparison of J Emerg Med. 2012;43:298-302.
9. Chandrasekaran S, Kumar S, Bhat SA, Saravanakumar, Shabbir PM, Chandrasekaran V. Awareness of basic life support among medical, dental, nursing students and doctors. Indian J Anaesth. 2010;54:121-6.
10. Körber MI, Köhler T, Weiss V, Pfister R, Michels G. Quality of basic life support–a comparison between medical students and paramedics. J Clin Diagn Res. 2016;10:33-7.
11. Ulger H, Deniz T, Saygun M, Ciftci N, Karakus A, Kandiş H. The efficiency evaluation of the training activity given to ambulance personnel. TAF Prev Med Bull. 2013;12:151-6.
12. Quraishi MK, Hanif UK, Parmar R. Improvement in Confidence Levels for the Management of Paediatric Cardiac Arrests in Medical Students Following a Training Course. Anesth Pain Med. 2018;8:e14867.
13. Bishop R, Joy B, Moore-Clingenpeel M, Maa T. Automated Audiovisual Feedback in Cardiopulmonary Resuscitation Training: Improving Skills in Pediatric Intensive Care Nurses. Crit Care Nurse. 2018;38:59-66.
14. Binkhorst M, Coopmans M, Draaisma JMT, Bot P, Hogeveen M. Retention of knowledge and skills in pediatric basic life support amongst pediatricians. Eur J Pediatr. 2018;177:1089-99.
15. Dal U, Sarpkaya D. Knowledge and psychomotor skills of nursing students in North Cyprus in the area of cardiopulmonary resuscitation. Pak J Med Sci. 2013;29:966-71.
16. Ok O, Vatansever K, Araz EŞ, Ergün V. Improvement of Chest Compression Quality in Prehospital Cardiopulmonary Resuscitation. J Anest Reanim. 2016.14:69-77.
17. Smereka J, Iskrzycki Ł, Makomaska-Szaroszyk E, Bielski K, Frass M, Robak O, et al. The effect of chest compression frequency on the quality of resuscitation by lifeguards. A prospective randomized crossover multicenter simulation trial. Cardiol J. 2018. doi: 10.5603/CJ.a2018.0121. [Epub ahead of print]
18. Chang MP, Lyon CB, Janiszewski D, Aksamit D, Kateh F, Sampson J. Evaluation of a cardiopulmonary resuscitation curriculum in a low resource environment. Int J Med Educ. 2015;6:136–141.