Studying the Extent of Compliance with the Standard Principles of Cardiopulmonary Resuscitation in the Selected Educational Centers of Mazandaran University of Medical Sciences 2016-2017

Narges Masoudi Sani (1)
Hedayat Jafari (2)
Mohammad Ali Heidari Gorji (3)
Nouroddin Mousavi Nasab (4)
Farzad Bozorgi (5)
Vida Nesarhosseini (6)

(1) MSc Student in Nursing, Student Research Committee, Faculty of Nursing and Midwifery, Mazandaran University of Medical Sciences Sari, Iran
(2) Traditional and Complementary Medicine Research Center, Addiction Institute, Medical Surgical Nursing Department, Mazandaran University of Medical Sciences, Sari, Iran
(3) Department of Medical- Surgical Nursing, Mazandaran University of Medical Sciences, Sari, Iran
(4) Faculty of Health, Mazandaran University of Medical Sciences, Sari, Iran
(5) Department of Emergency Medicine, Faculty of Medicine, Mazandaran University of Medical Sciences , Sari, Iran
(6) Department of Cardiology, Mazandaran University of Medical Sciences, Sari, Iran

Corresponding author:
Hedayat Jafari
Traditional and Complementary Medicine Research Center, Addiction Institute,
Medical Surgical Nursing Department, Mazandaran University of Medical Sciences,
Sari, Iran

Received: December 25, 2017; Accepted: December 30, 2017; Published: March 1, 2018. Citation: Narges Masoudi Sani. et al. Studying the Extent of Compliance with the Standard Principles of Cardiopulmonary Resuscitation in the Selected Educational Centers of Mazandaran University of Medical Sciences 2016-2017. World Family Medicine. 2018; 16(3):19-23. DOI: 10.5742/MEWFM.2018.93299

Abstract

Background and Purpose: Since relatively large changes have been applied to the American Heart Association's Guidelines 2015, skill, knowledge, and awareness of the resuscitation team of the latest guidelines can greatly affect the outcome of cardiopulmonary resuscitation. Therefore, the research team studied the performance of the resuscitation team by examining the extent of compliance with the standard principles of CPR based on the latest scientific and specialized guidelines.

Materials and Method: This was an observational cross-sectional study conducted in a one-year period, from December 2016 to December 2017 in connection with the efficiency and quality of resuscitation in 194 patients with deadly arrhythmias or cardiac arrest in emergency ward of Bu'ali Hospital in Sari, Aziz Hospital in Juybar and heart center of Fatemeh Zahra Hospital in Sari. The effectiveness of resuscitation in patients was measured by the relevant checklists and the results were analyzed and reported with SPSS 20.

Findings: The samples consisted of 40.7% women and 593.3% men with the mean age of 17.34 ± 68.56 years old and there was initial blood circulation return in 13.4% of them. There was 86.6% of compliance with the depth of chest compressions ≥ 2 inches, 91.8% of compressions over 100 /min, 32.6% of frequent discontinuation of cardiac compressions for various and less important reasons, and 26.8% of delayed resuscitation to make an airway.

Conclusion: Based on these findings, the result of cardiopulmonary resuscitation in hospitals was still low. In order to change this situation, re-educating, updating knowledge, and improving the skills of the medical staff as well as forming a skilled resuscitation team should be the priorities of hospital planning.

Key words: Cardiopulmonary resuscitation, quality and outcome of resuscitation, Utestein, cardiopulmonary resuscitation skills, Cardiac arrest in hospital

Introduction

Cardiac Arrest is an unfortunate event that can occur unexpectedly at any time and place with high mortality(1). Cardiopulmonary arrest is one of the most important and urgent medical issues (2) and it is one of the major causes of death in the world (3) which requires a quick and effective response (4). Cardiopulmonary resuscitation or CPR is a process by which the life of the individual can be sustained by restoring the vital organs of the body, the heart and the lungs (5). The ideal result of a resuscitation operation is the complete return of a patient, but it is worth noting that there are many issues involved, including underlying illnesses, the time between cardiac arrest and starting resuscitation, the availability of qualified staff and supplies required for this operation, and other issues (6). Quality resuscitation is the first component affecting cardiac arrest. Significant changes were made in the American Heart Association's (AHA) Guideline, with emphasis on implementing high quality CPR techniques with its five combined components of minimizing interruptions in chest compressions, performing compressions with the proper depth and number, avoiding unnecessary work between compressions, and hyperventilation (7). Given the changes in therapy algorithm of the cardiac rate rhythm during recovery, during resuscitation and the order of the steps, the knowledge, skills and awareness of the resuscitation team of the latest guidelines is an immediate and vital issue for saving human lives in the critical moment of struggling life which can greatly affect the outcome of cardiopulmonary resuscitation (8). Rescuing a patient from cardiac arrest involves the three components of medical science, effective training, and proper implementation. This suggests the importance of skill in saving the patient. Brain damage occurs 4-6 minutes after the delay in oxygenation to the brain; therefore, due to this short time, lack of enough information and skills leads to the death of people. Many hospitals have a cardiopulmonary resuscitation team that takes advantage of advanced technology during cardiopulmonary arrest. However, the patients' survival and discharge rates after cardiac arrest have remained stable at 14.7% in the United States and 16.7% in England over the past 30 years (9). Regarding the fact that many years have passed since the onset of cardiopulmonary resuscitation, unfortunately, the performance of the resuscitation team in hospitals is weak and disturbing, so that during a study conducted in three educational hospitals in Tehran, 64.4% of the resuscitations were unsuccessful and only 2.7% of the patients with moderate to good brain function were discharged from the hospital (10).

Given that nurses are the first to come to the patient at the time of cardiopulmonary arrest, their knowledge and skills in implementing the most up-to-date and most effective cardiopulmonary resuscitation protocols can have an effective role to help increase the success rate, reduce the CPR time, and thus reduce rate of mortality and morbidity. On the other hand, due to the annual holding of training courses for cardiopulmonary resuscitation in the selected treatment centers of Mazandaran University of Medical Sciences, we decided to study the degree of compliance between knowledge gained and its practical implementation by the CPR team in the emergency department of these centers by examining the compliance with the CPR standard principles based on the latest scientific and specialized guideline.

Materials and Methods

The present study is a descriptive cross-sectional study in order to assess the compliance with the standard principles of cardiopulmonary resuscitation in the emergency department of Bu'ali and Fatemeh Zahra Hospitals in Sari and Azizi Hospital in Juybar affiliated to Mazandaran University of Medical Sciences during a 24-month period. The statistical population of the research included 194 over 18 years of age, non-traumatic patients with sudden cardiopulmonary arrest who were not pregnant women and who had cardiopulmonary arrest outside the hospital or in the acute and subacute emergency department of the hospital. Data collection tool in the first step was to use the Utestein standard form of cardiopulmonary resuscitation reporting in the hospital (11) which was completed by the researcher through observation and if necessary, using medical records and getting help from medical personnel and relatives of the patients present during resuscitation and after the completion of the resuscitation. In addition, the Advanced Cardiopulmonary Life Support Evaluation checklist was also used (12). This checklist contained 33 evaluation questions in a "Yes" and "No" manner based on basic resuscitation steps according to the algorithm of AHA 2015(13) which considered score one for the performance at a standard level and zero for the performance below the standard level. Validity of this tool was examined in research by Smally et al. with a correlation coefficient of 0.96%, which was re-evaluated for its operation and use in this study based on the latest and the most recent American Heart Association Resuscitation algorithm (2015). The tool was translated into Persian and the validity of the tool was carried out in the form of content validity review, so that after translation, the checklists were given to 10 specialists of nursing, emergency medicine, and heart to examine the content and face validity of the tool and their comments were implemented on the checklist after arguing in a special panel. Then the tool was returned to them to have their opinion on its content validity. Subsequently, the content validity index (CVI) and the content validity ratio (CVR) were calculated as 0.89 and 0.85, respectively. After preparing the final checklist, in order to measure its reliability, despite reliable, the method of agreement between observers was used to confirm the reliability of the tool. For this purpose, the checklist was provided to the two observers, who simultaneously completed the checklist for 50 observations related to cardiopulmonary resuscitation, and then, in-class correlation coefficient between the scores obtained from the two observations was calculated as 0.85. To complete the checklist, a researcher and three research assistants (one from each center) were used who were trained for this purpose and developed basic and advanced CPR courses based on the protocol provided by the AHA for 2015. During a two-hour briefing session, they were given the information

on how to complete the checklist. The evaluators did not intervene at the time of the resuscitation, but if needed they participated in the resuscitation. Actually, the intended samples were removed from the study. The members of the resuscitation team did not have any information about the content of the checklists, but they were aware of the purpose of the researcher. Based on the patient's rhythm under the CPR, the necessary measures were taken in the same rhythm and presented step by step in the form of questions and the related questions about the same rhythm were filled and included rhythms of Bradycardia, Fibrillation and ventricular tachycardia without pulse and asystole and Pulseless Electrical Activity (PEA). In addition, the evaluators were continuously present in the resuscitation room before and after the arrival of the patient and the resuscitation team so that they observed the activities performed during the resuscitation process. The evaluators simultaneously reported the resuscitation by filling in the checklist the quality, number, and depth of chest compression, interruption for more than 10 seconds in checking the carotid pulse, the type and dosage of the drug used, the use of defibrillation when needed, and airway assessment based on the checklist. Each item was scored ultimately, correct performance of the skill or the correct method was scored one and incorrect performance or use of wrong method was scored zero. Initial results included the return of spontaneous circulation or failure to resuscitate and the secondary results included quality CPR and following international guidelines of CPR. Data from the study was analyzed using the SPSS 20.

Findings

The present study was conducted to determine the compliance with the standard principles of cardiopulmonary resuscitation in the selected centers of Mazandaran University of Medical Sciences and inclusion of 202 patients with cardiopulmonary arrest. Eight patients were not recognized eligible and were excluded from the study due to rigor and failure to perform resuscitation on them. The study was performed on 194 remaining patients. Of these, 115 (59.3%) were male and 79 (40.7%) were female. The mean age of the participants in this study was 68/56 ± 17/34 years (the age range was 18-98 years). In the study of rhythm frequency in the 194 patients in this study at the time of entering the hospital, 7.7% had a Shockable rhythm, 57.7% had un-shockable rhythm, 2.6% had Bradycardia rhythm, 0.5% had atrial fibrillation rhythm, and 4.9% had sinus rhythm. In the cases of sinus rhythm, 73.77% had rhythm changes due to asystole and 26.23% had rhythm changes due to other rhythms. The average resuscitation time, which is the time interval between the beginning and end of resuscitation, was 44.83 ± 24.56 minutes (range from 10 to 200 minutes). When the frequency of resuscitation operations was compared in four intervals of 6 hours (intervals of 12: 00 am -6: 00 am, 06: 00 am -12: 00 pm, 12: 00 pm -06: 00 pm and 06: 00 pm-12: 00 am), the most resuscitation operations were carried out between 12:00 pm to 06:00 pm and the lowest resuscitation operations were carried out at 12: 00 am - 6: 00. In the present study, Return of Spontaneous Circulation (ROSC) less than 20 minutes was considered as successful resuscitation, which was seen in 26 patients (13.4%). When the relationship between resuscitation duration and ROSC was analyzed using Pearson correlation test, we found a significant negative correlation between these two parameters (r = -0/338 and p =0.000). In other words, the patient's return and resuscitation success were more pronounced during the shorter resuscitation period.

In this study, the rate of observance of the standard principles of cardiopulmonary resuscitation during resuscitation operations on the patients was also examined through a checklist of questions. These questions were set up as a general intervention package for all patients and a series of special interventions that were tailored to the patients' initial rhythm. The measures taken to manage an airway in 26.8% happened with a delay of more than 10 seconds in resuscitation to insert the endotracheal tube. In total, 93.38% of resuscitation cases were performed with correct procedures for airway management in patients undergoing cardiopulmonary resuscitation. In the evaluation of the correctness of chest compression measures, the onset of 19.6% of chest compression was delayed and 32% of the resuscitations had repeated interruptions for various reasons. In total, chest compression in 86% of the cases of resuscitations was performed properly in these centers. In the evaluation of the correctness of medication in cardiopulmonary resuscitation operation, 32.4% of the amiodarone ampoule injections were less than the dose prescribed in the AHA resuscitation algorithm 2015. Moreover, due to the removal of atropine ampoule in the treatment algorithm for asystole rhythms and Pulseless Electrical Activity (PEA), 2.7% of the resuscitations cases still had injections of atropine ampoules. In total, medication in 96% of cardiopulmonary resuscitation operations in these centers was done correctly. In assessing the correctness of electrical shock during cardiopulmonary resuscitation, taking into account the asystole rhythms and PEA as un-shockable rhythms, electrical shock was used during 43.9% of resuscitation cases. In 100% of cases, the electric shock joule was between 120 and 200. Altogether, in 89% of the resuscitation cases, measures related to electrical shock during cardiopulmonary resuscitation operation were performed correctly in these centers.

Discussion

This study was conducted with the aim to evaluate the quality of skills performed during cardiopulmonary resuscitation operation. Thirty-three items were studied in the study, two thirds of which were performed correctly. In spite of the annual courses of cardiopulmonary resuscitation in the centers under this research and installation of cardiopulmonary resuscitation (2015) posters in the resuscitation rooms of all three centers, this study revealed some differences between the knowledge gained and its practical implementation by the cardiopulmonary resuscitation team at the emergency department. It is worth mentioning that the quality of cardiopulmonary resuscitation can affect its results(14). Numerous studies have shown that the probability of survival in those who had chest compression was higher than those who had no compression (14).

Chest compression is effective if it has the following three characteristics:
- Chest compression more than 100 /min
- Chest compression with a depth of more than two inches (6-5 cm)
- Interruptions at intervals of less than 10 seconds compression(15).

The results of the present study, after evaluating the quality of compression, were as follows: 91.8% of compliance with the rate of chest compression ≥100/ min, 86.6% of compliance with the depth ≥ 2 inches, and 91.2% of compliance with the appropriate angle and place. The highest incorrect actions while performing chest compression were failure of the chest to return to the initial state after each compression 32%, chest compressions was repeatedly interrupted for various and less important reasons 32%, and performing compression at a too high or too low speed 9.29% . In the study of Barimjejad et al. chest compression with inappropriate depth was 12% in the intervention group and 45.8% in the control group, inappropriate hand placement in the intervention group was 40% and in the control group was 76.8%, and inappropriate hand angle was 32.17% in the intervention group and 51.8% in the control group(8). In the study of Hesham et al., the number of compression ≥100/min was 99/2%, depth ≥ 2 inches was 92/4%, and pause more than 10 seconds to check pulse was 48/7% (15). In the study of Pourmirezakalhori et al., nurses' knowledge and skills regarding correct compression depth was 87.9%, correct placement of hands 82.6%, and compliance with the proper ratio of compression to ventilation 30:2 was 72.2%(16). In the study of Hosseini Nejad et al., correct amount of compression per minute was reported 84% (17). Although the findings of this study were in line with the studies of Hesham et al., Barim Nejad et al., and Hosseini Nejad et al., it showed many weaknesses during chest compression in these centers.

Despite the removal of the electric shock from the resuscitation algorithm in asystole and PEA rhythms, in the present study, there was an electric shock in 49.43% of patients with unshakeable rhythms. In the study of Pourmirezakalhori et al., nurses' knowledge of the amount of appropriate shock in VF/VT was reported as 26.8% (16).

In the present study, 26.8% of the resuscitations were interrupted due to delay in airway management. The results of the study of Barim Nejad et al., on oxygenation and airway management, delayed insertion of the endotracheal tube in the intervention group was 21.6% and it was 33.3% in the control group(8). In the study of Adib Hajbagheri et al. skills of nursing students, at three different times for airway management at the right time were evaluated and reported as 54/12%, 26% and 354/5%. In general, approximately 75 % of nursing students were successful in performing chest compression and respiration (3).

Giving medicine may be considered a simple process during resuscitation, but it is one of the most important skills of resuscitation. Given the many changes that have taken place in the cardiopulmonary resuscitation guideline 2015 on giving medicine, it should be emphasized that the awareness of our hospital's resuscitation team has not been very accurate in this regard. Amiodarone ampoule was used in 97/3% in VF/VT rhythms of which 32.4% of them was less than the appropriate dose. Atropine ampoule was also injected in 2.7% of the asystole / PEA rhythms despite its removal from the above medical algorithm. In the study of Hesham et al., Atropine was injected in 65 patients with asystole /PEA and the absence of amiodarone injection after the shock was reported in five patients (71.4%)(15).

Table 1: Data distribution in the studied indices in the evaluation of cardiopulmonary resuscitation

No (number (%))	Yes (number (%))	Items
(80/4) 156	(19/6) 38	Chest compression began with a delay.
(86/6) 168	(13/4) 26	Compression was done at a depth of 4-2 inches (6.5-9.8 cm).
(8/2) 16	(91/8) 178	120-100 compressions per minute were given.
(91/2) 177	(8/8) 17	The placement and angle of the hand for chest compression was inappropriate.
(9/3) 18	(90/7)176	The hands were folded vertically without bending the elbows in the center of the patient's chest.
(18) 35	(82) 159	After each time, thoracic compression was given to the chest.
(99) 192	(1) 2	The masseur was one person during the entire resuscitation period.
(68) 132	(32) 62	Frequently interrupted chest compressions for various and less important reasons (Such as taking intravenous line, sticking chest leech, intubation, etc.)
(86/6) 168	(13/4) 26	Discontinuation of chest compression after every shock.
(70/1)136	(29/9) 58	Heart rate compression was done very quickly or slowly.
(76/6)25	(32/4) 12	Inappropriate amount of amiodarone or lidocaine in VF/VT was given.

In the study of Pourmizakellari et al., nurses' awareness in using amiodarone for ventricular dysrhythmia was reported as 58.6% (16).

Taking into account the results of this study, it is concluded that the skills, such as: continuous chest compression with the least interruption, use of electric shock, immediate start of resuscitation, and medicine use which is emphasized in the guidelines . Considering the fact that cardiac resuscitation is a complex process that is always under high stress, having the knowledge and skills in any of these cases can improve the results. While it is believed that CPR is performed correctly in the centers studied, despite cardiopulmonary resuscitation training classes annually for all medical personnel, the results of this study showed that CPR in these centers is still far from ideal. The difference between the gained knowledge and its practical implementation by the CPR team in emergency centers reveals the fact that the resuscitation team should consider these shortcomings and weaknesses and have more practical training such as a workshop with different scenarios and be alert in this regard.

Appreciation
The researchers are thankful to the dear management of nursing, chief and colleagues of Bu'ali Sina and Fatemeh Zahra Hospitals in Sari and Azizi Hospital in Juybar, respected patients, and all those who somehow helped us in this study.

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